WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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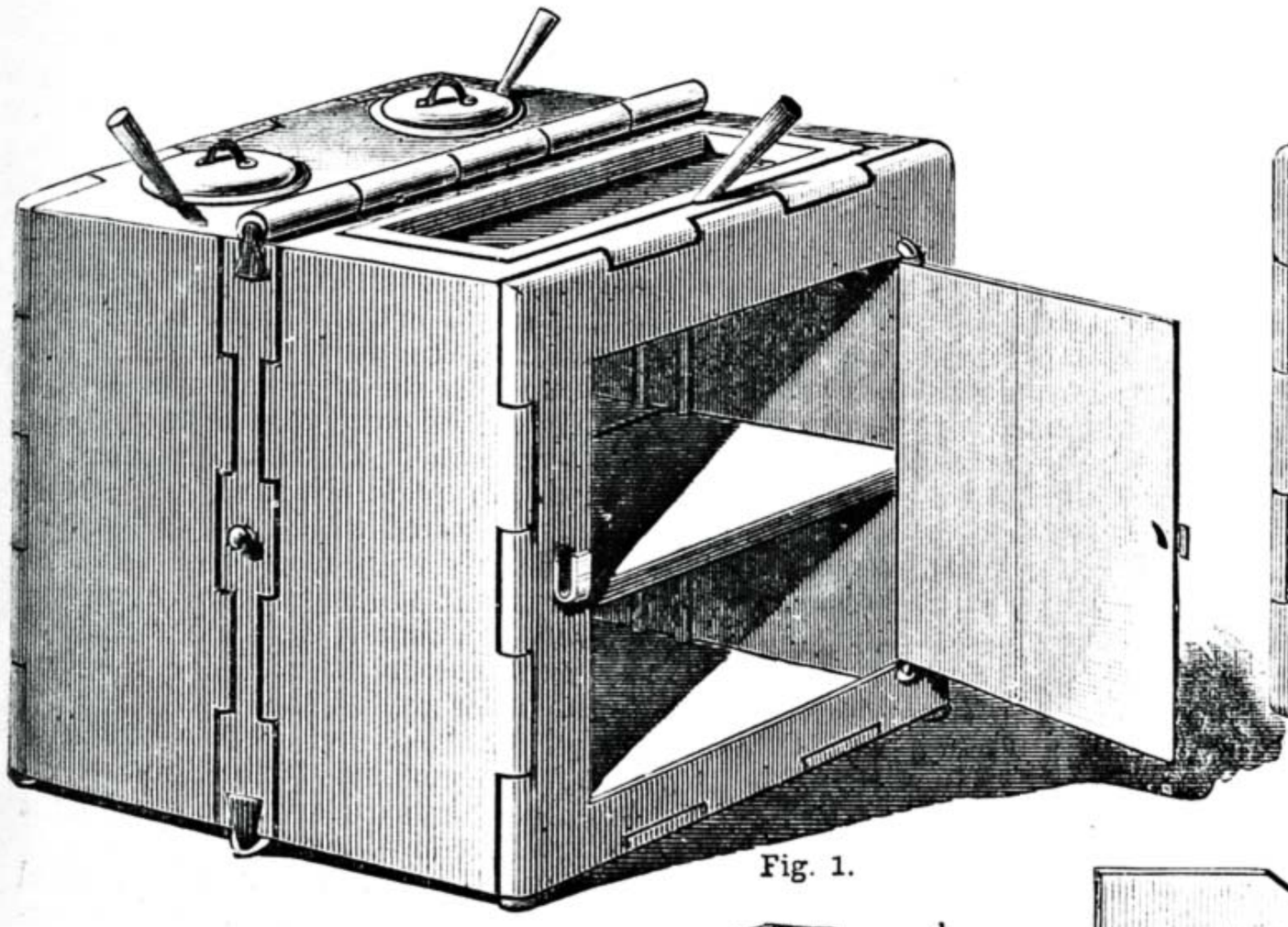

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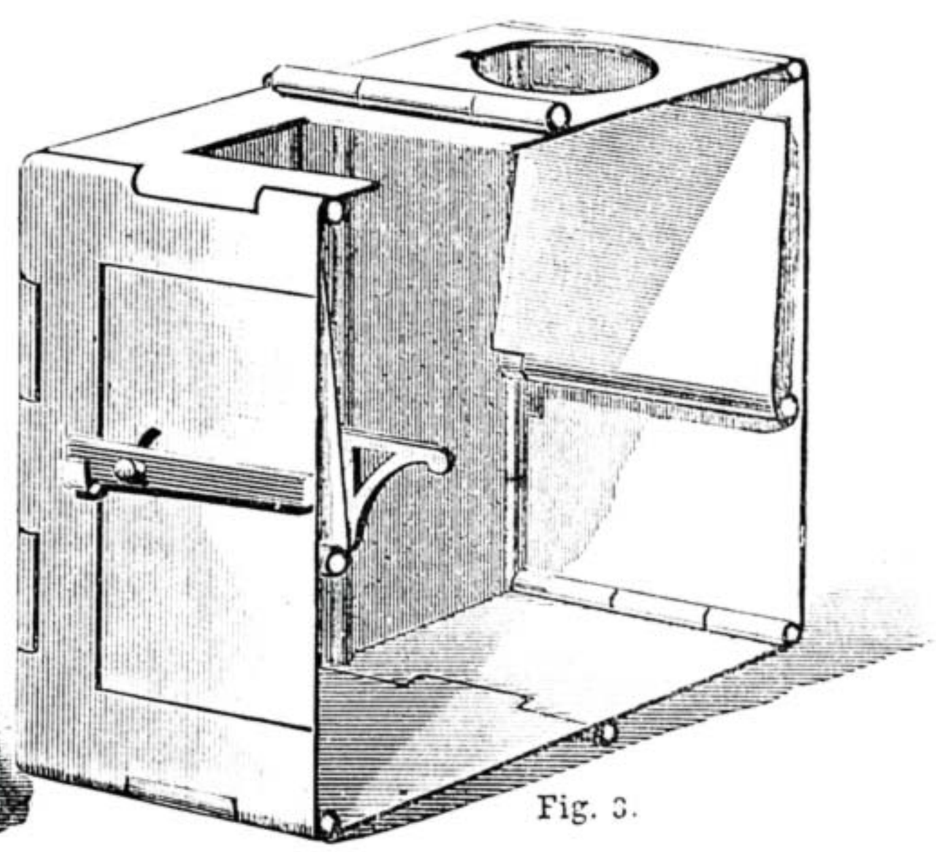

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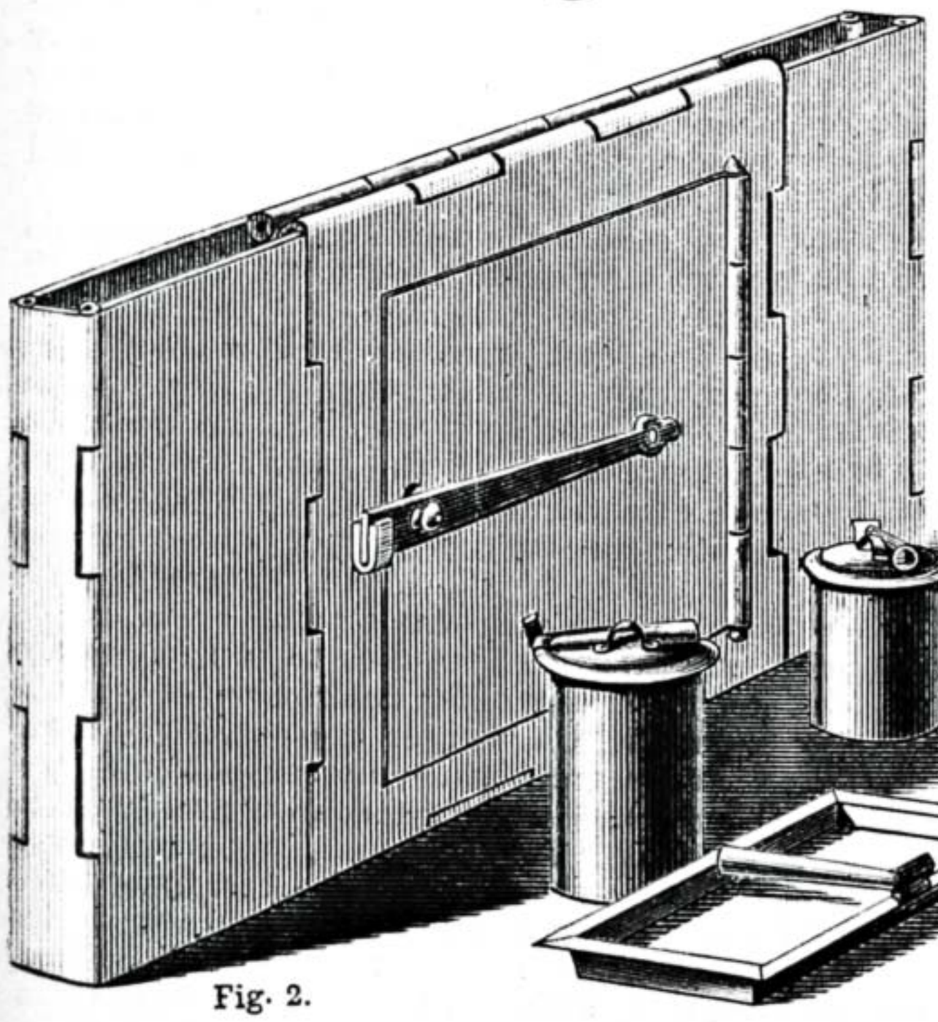

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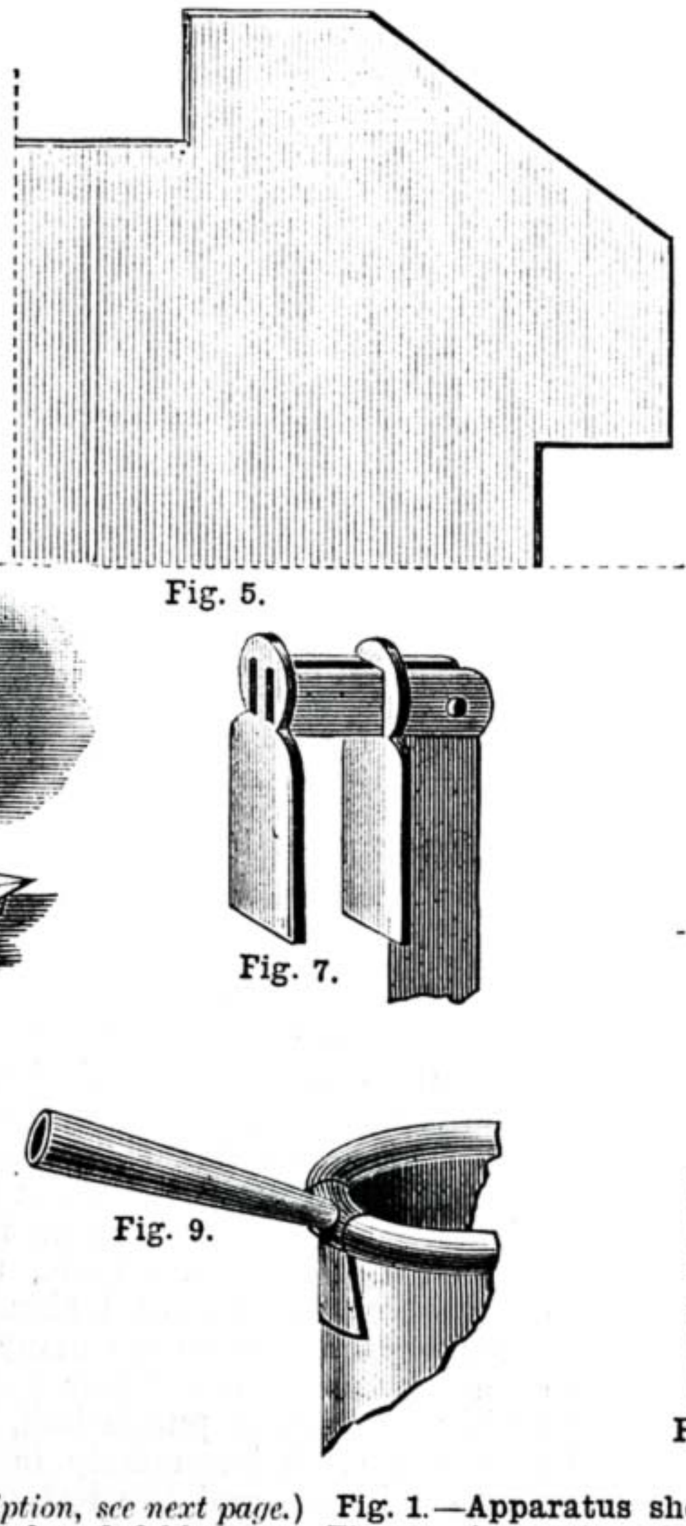

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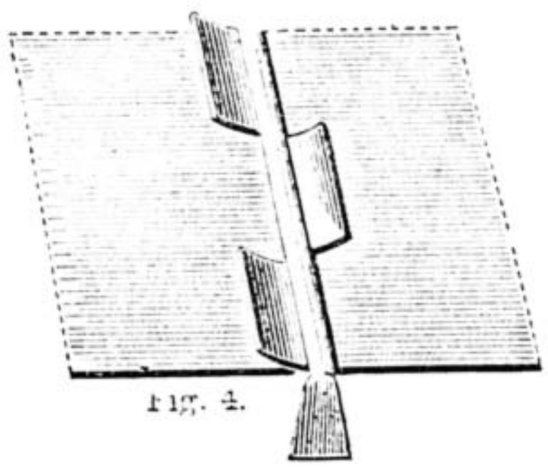

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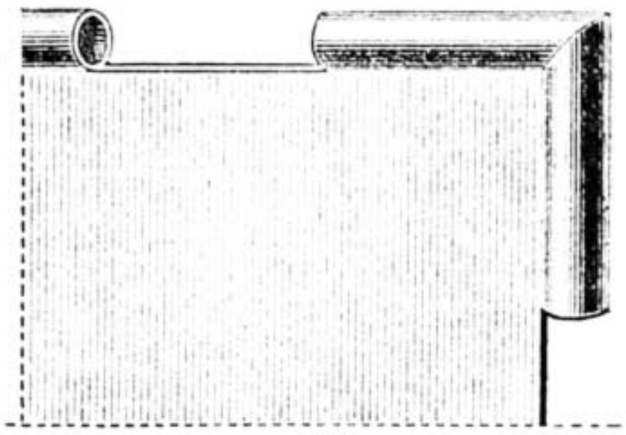

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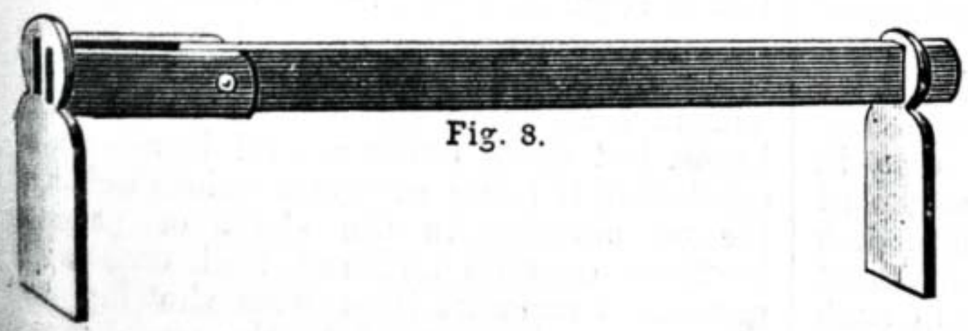

Fig. 8.

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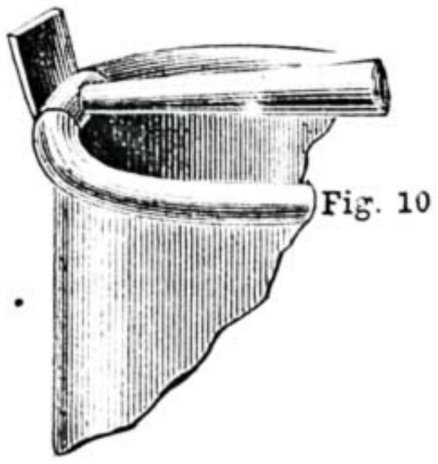
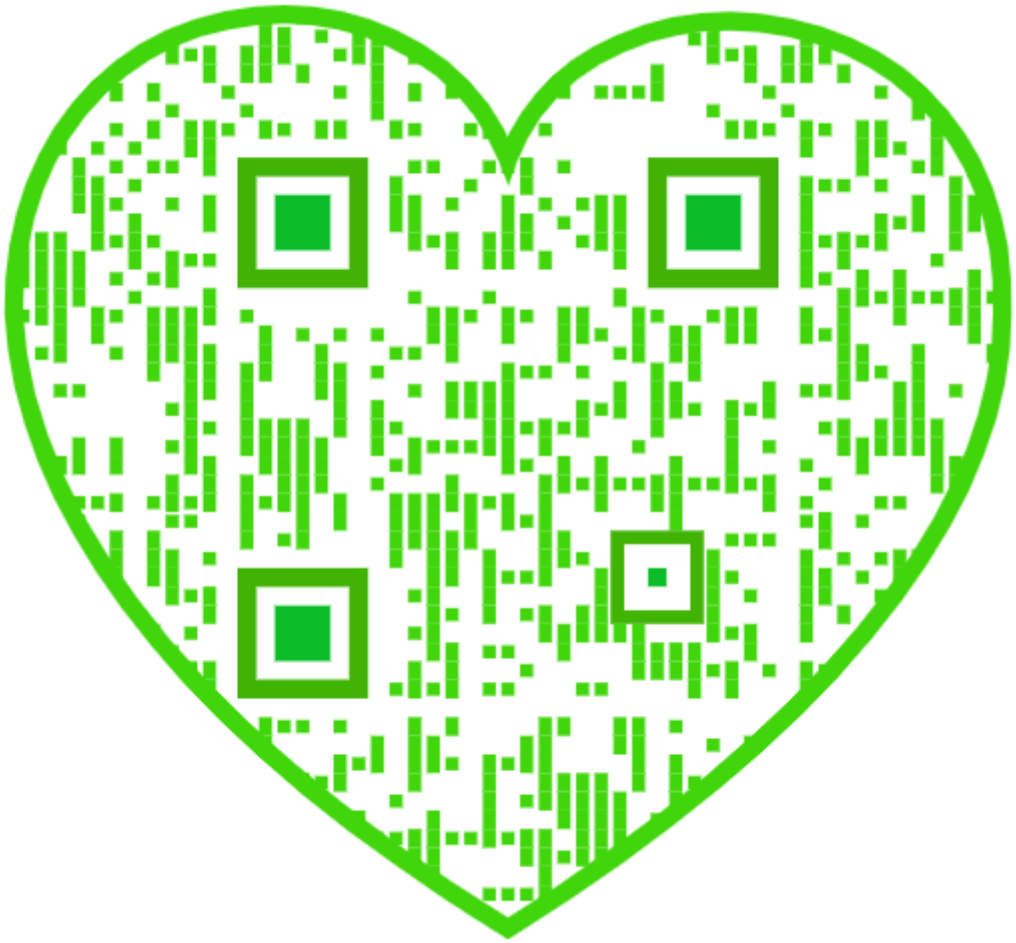


Fig. 10

A FOLDING COMBINED COOKING STOVE AND OVEN. (*For Description, see next page.*) **Fig. 1.—Apparatus shown complete and opened out, ready for use as Oven or Cooking Stove. Fig. 2.—Apparatus shown closed and folded up. Fig. 3.—Apparatus shown cut in half and exhibiting Interior at Back. Fig. 4.—Method of fixing Top and Bottom Centre Rod. Fig. 5.—Diagram showing Corner before being bent and rolled. Fig. 6.—Corner after bending and rolling. Figs. 7 and 8.—Suitable Handles for fitting on Apparatus. Figs. 9 and 10.—Diagrams showing mode of making Saucepan Handles. Fig. 11.—Bracket to support Rod on which Oven Bottom revolves.**



A FOLDING COMBINED COOKING STOVE AND OVEN.

BY JAS. SCOTT.

"THE early bird catches the worm." If this is so, it proves that there is not so much good advice contained in the proverb as is generally supposed, for the worm, although an earlier riser than the bird, meets with very great disadvantages from rising so early. But perhaps it may be argued that the "early bird catches the worm" at home, before it—the worm—has started out for its day's business. However, whichever side of the question is right, a great deal may be said both in favour of and against early rising.

My purpose in this article is to lay a few suggestions before the reader, whereby he may profit if he be an early riser. I know several young men who have to start to their work before six o'clock in the morning. One of them is a single lodger, and prepares his own breakfast; the others live with their parents. Now, as it is necessary for them to rise at so early an hour, with the one exception, they have not time to cook their own breakfasts, so that that task devolves upon the mother, who probably retires to rest after she has satisfied her son, and has no need to rise again until two or three hours afterwards. By allowing the mother, or sister, as the case may be, to have her rest comparatively undisturbed, would not encourage idleness, for it may be safely presumed that what is needed to be done will be done.

How nice then for the son when he rises to prepare his own meal without taking up much of his time, and without disturbing the rest of any one else! There are numerous small handy cooking stoves about, and there is no reason whatever to be urged against their use, instead of lighting a coal fire.

I have designed the cooking apparatus here shown so that it can be used as an oven, or for boiling water, and frying any necessaries or luxuries; it can be also compressed, and carried backwards and forwards to work, or stowed away in some corner.

Very little requires to be said about the measurements, the sizes of course being optional. If made 15 in. square, I think that would be a very convenient size. It will be observed that the top and bottom fold together, while the two sides extend outwards. The rods round which the sides are bent should not be very thick, but they must be firm and strong.

Fig. 5 shows how each corner of the back and front should be cut, so that when each piece is bent round the rods they will fit properly, as shown in Fig. 6. Fig. 4 shows the centre rod at the top, the bottom one being similar. They should be a few inches longer than the others, and should be hammered flat at the ends, and bent at right angles; it will then be found that they keep the stove compact. For the benefit of those who do not know, I may as well give a hint for cutting the edges that are to fit round the rods; whatever the diameter of the rods, the pieces which bend round them should be three times the width of the diameter; thus, if the rod is $\frac{1}{4}$ in. thick, the pieces to be cut out at the sides should be $\frac{3}{4}$ in., leaving those pieces projecting (as shown in Figs. 4 and 5) $\frac{3}{4}$ in. wide to bend round them.

I have shown the apparatus as an oven as well for those who may desire it, but I should not like to say I expect it to possess all the merits of the small portable ovens that are now so largely made; but, if well made, I see no reason why it should not answer its purpose satisfactorily. If no oven is required, the stove should not be made quite so high, and the top only should fold in, the two sides and bottom extending outwards.

For the bottom of the oven I have shown two flaps (Fig. 3). Each should be about 9 in. wide, and one should be fixed slightly higher than the other, so as to overlap it. The small iron brackets shown should be soldered on to the inside of the two narrow middle side pieces, while on the outside of these pieces is a small knob, to facilitate opening and folding the entire article.

I should not advise the amateur to try his hand at the saucepans and frying pans. He can buy them already made, and can use his skill by fixing the movable handle I have shown in Figs. 9 and 10. A firm hollow rim should go round the tops of the above named articles, to support them in their positions. Where the handle is to go a piece should be cut out. The handle is an ordinary one, and is fastened into a piece of metal, the end of which has been bent round to the same diameter as the rim. A hole should be made in the rim on either side of the handle, so as to admit a short piece of strong wire to fix the handle in position. Saucepan handles are frequently a source of great inconvenience, and as there is not likely to be much weight brought to bear upon these, I think they will be an advantage.

Fig. 11 shows the shape of the supports to be fixed to the inside of the stove, upon which the flaps composing the oven bottom revolve. Fig. 7 is intended as a handle for carrying the whole affair about; I have not shown it in any of my drawings, but it will be found useful. Pieces are fixed at either side of the stove, one having a slot in it, through which runs the long top piece. A small piece must be cut out of the side of each of the three top openings, to allow the handle admittance; and I believe it will be found that the ventilation through these, when the affair is used as an oven, will be quite sufficient.

I say nothing here about the lamps; that must be left to the reader, as they can be obtained anywhere and everywhere: neither do I speak of the door fastening; the working of it must be apparent to all, and the hinge will be precisely the same in construction as the corners of the stove.

The job should be made in tin, with the oven bottom of iron.

SIGN WRITING AND LETTERING.

BY HENRY L. BENWELL.

THE PREPARATION OF SIGNBOARDS AND THEIR GROUND COLOURS.

SOME time since a practical man recommended the use of American cloth or leather as a surface for the sign writer to work upon. I have never given it a trial, but we all know the material, as it is frequently seen on the cottager's table, and also in many kitchens. I have, I should say, used it for temporary purposes many times, such as a bazaar or fancy fair announcement taking place at a public hall, but in such cases the cloth has merely been stretched on to a frame, and the letters have been painted direct on to the black shining surface. This, though, is a simple expedient as a cheap substitute for a proper signboard, and is entirely different from the method employed by my practical friend, which I will now describe.

The face of the signboard should be covered with the best stout American cloth, which is made to adhere, first of all, to the board with bootmaker's paste, viz., glue, flour, and alum. The cloth must be of sufficient dimensions to lap over the edges of the board where it is closely tacked down all round with *tinned* tacks. Do not on any account use iron or blue tacks, as they rust and very soon rot the fabric. The cloth should dry out perfectly taut and free from wrinkles. We next paint the edges of the board where the tacks are with a good round coat of red and white lead mixed as a further preservative, taking care to keep the front of the cloth surface clean. The mouldings, which have already been primed and received one coat of paint, are next tacked on, and the nail holes, joints, etc., well stopped with putty. The back of the board and the beadings, etc., next receive three good coats of paint made up into a slate colour, with black and white and red lead. The cloth itself, being of a shiny and hard non-porous surface, requires but two thin coats of paint, mixed with equal quantities of copal varnish, raw linseed oil, and turpentine. This first coat must be allowed to get perfectly hard, when it is lightly glass-papered with Oakey's No. 0 or No. 1, and it is then ready to receive its second coat. If the sign is to be written on before varnishing, it should be "flatted" in the same colour as used for the first coats, and, after getting thoroughly hard, it is ready for "setting out" the matter thereon. The medium for binding on the flatting should be copal varnish, which must also be used for finishing off the sign.

I do not myself think this method possesses any lasting qualities. It is, nevertheless, a handy dodge for covering up very old and badly cracked name-boards over shop fronts where the tenant does not care to go to the expense of having a new board inserted.

In concluding this subject, I cannot do better than quote the method employed by Mr. William Sutherland of Manchester, one of the best workers, and a recognised authority on all matters relating to sign writing, marbling, and its kindred arts, that we have in the provinces. I shall call attention to the literary work of this gentleman at the end of these articles when recommending an advanced textbook on the sign-writer's art.

"A signboard requires to be as smoothly got up as any other description of painted work, and the clearer the polish or lustre, and the freer from nits or grit it is, the better the work afterwards put upon it will look. This is especially the case when the letters are gilt. The smoother the surface, the brighter and more lustrous will be its burnish. It should, therefore, be pointed out that, although there will be some extra labour required to get up the work properly, its appearance when finished will amply repay the trouble bestowed upon it. . . . . The first thing to do will be to kill the knots, but there never should be any in a signboard, it being always a serious defect; for no covering in the shape of patent knotting or glue and red lead, etc., will prevent a resinous knot from showing on the surface if exposed to the sun's rays. And the only effectual cure in these cases is to cut out the knot and let in a piece of sound wood in its place. . . . . For priming, use any of the dark reds or browns, red oxide, purple brown, etc., mixed with

raw oil. The second and third coats should be brown also, but mixed with one-third turps to two-thirds of oil, having a little liquid dryers added to harden it. All the paint used should be carefully strained before being used, and well rubbed down between each coat. If this is not done, we are apt to accumulate on the surface of the board a quantity of coarse particles of colour and skins of paint which are afterwards very difficult to get rid of. . . . . To finish the board off with a black ground, we first give the sign a bare coat of black oil colour upon the previous three coats of brown. We then grind drop black in turpentine, stiffish, and then add sufficient japanners' gold size or varnish to bind it, and with this carefully coat the sign over. When this is dry and hard, we finish with one or two coats of copal varnish."

In writing a fresh inscription upon an old signboard, it is frequently found to be necessary to clean off all the old material, and otherwise "doctor" it, before it can be made fit for repainting. The old paint must, therefore, be burnt off with the spirit torch, and the board well rubbed down with some sharp new glass-paper until smooth. All holes, cracks, and other imperfections, should next be made good with white lead and putty, and the knots freshly coated with the usual preparation. The board should now be primed with red and white lead, half and half, with the usual quantity of oil and turps. I am always in favour of this priming for all new work, as it has such protecting power and soon dries quite hard, whilst the oxides of iron and the earths have little or any body in them, and are, consequently, unfitted for withstanding and resisting the climatic changes of any country.

A few words of caution here may, perhaps, be the means of preventing a few young hands from making bad work the result of their first efforts :—

1. Always use raw linseed oil for the face of signboards.

2. Always use pure, uncoloured turpentine.

3. Always use the same dryer throughout a job, and do not use one kind in one coat of paint and another in the next or finishing coat: the different chemical actions of the two substances will not agree, and very likely cause the paint to crack, etc.

4. For the same reasons, always use the same quality of varnish and the best procurable : outside copal and outside oak. The best boatbuilders' varnish will be found an excellent preservative when the board is varnished before lettering, as it is made with the special object of resisting water and the sun's action. As it is somewhat dark, I cannot recommend it for varnishing after lettering or on a light-coloured ground.

5. Well strain your paints and pigments.

6. Do not use boiled oil, except for the back of your signboards.

7. Let each coat get thoroughly hard before applying the next—quite hard, and not merely dry.

8. Also, never rub down with glass-paper until quite hard, and be careful not to rub portions of the previous coat "up" or "clean off," or your surface is spoilt.

9. Last and most important : do not have your paint too thick or containing too much oil. Do not let each coat be too round; it had better be laid on too sparingly than otherwise. Well work each coat about with the brush in every direction, and finish by "laying off" evenly in one direction and with a light hand, leaving no brush marks. This last remark also applies to varnishing. This rule must be attended to in order to prevent the sign from blistering.

Much might here be said as to the general tints and shades of colour which show off the lettering to the best advantage, but as space is limited, a great deal must be left to individual taste and knowledge. For gold lettering, a black groundwork is always the most effective, as the letters show up plainly at whatever angle they may be viewed from ; this is not so with a white or any other light ground. Gold letters also look well on a dark blue or bronze green groundwork. They also show up wonderfully well, when properly shaded, on a ground of Chinese red. This is the colour used on the mail carts, but, as it is particularly liable to fade when exposed to the light and weather, several coats of "flatting" must be applied, and after the gold leaf has been affixed, it must be well protected with two good coats of varnish. A black letter shows up the best on a white ground, but it may not be generally known that a *white letter* on a *black ground* is a great deal more effective than *vice versâ*. At least, this is the opinion of a great many of our best writers, who have frequently pointed it out to the author of these articles. This is more so the case in very small lettering, and on a limited space containing a lot of matter, such as a "Trespassing Notice Board," or auctioneers and land agents' boards, which generally commence with "This valuable plot of freehold land to be sold for building purposes, etc.," and such like examples. Boards of this class, I confidently assert, can be read much easier and at a greater distance—especially by short-sighted people—if the letters are in white on a black ground. Do not, however, use white lead, but oxide of zinc, or, better still, some Charlton white. That is, of course, if the tube colour is not used, which is the rule for common work of this class. If the tube colour is used, resort may be had to flake white, which is the carbonate of white lead oxidised, and which does not consequently discolour so quickly on exposure to the atmosphere.

With reference to other kinds of grounds, there is a species which one frequently sees lettered upon, especially on shop facias, and that is the marbled or grained surface, which exhibits very bad taste indeed when an inscription is written thereon in the ordinary style. It frequently looks as if the grain of the wood or veins in the marble are springing out in all directions from the letters themselves. I have no sympathy whatever with a grained ground, and would strongly urge the employment of a plain colour, which harmonises with the graining colour around it. If a grained ground is used at all, it should imitate a wood totally different to that which is used for the rest of the work, and also contain a small close grain.

In writing on an imitation marble surface, only one class of letter looks really well, and that is the incised letter, or, rather, the imitation thereof. It is a difficult letter, and wants a lot of skilful handling to look effective and real. If the whole of a shop front is marbled, and the name to be inscribed also on a marble surface, the facia or signboard should be worked in a different marble of a somewhat lighter tone, and so as to resemble an inlaid slab which has the appearance of being let into the rest of the structure.

SMITHS' WORK.

BY J. H.

MEDIÆVAL SMITHS' WORK—THE IRON WORK THAT WAS MADE, AND THE MODE AND METHOD OF MAKING IT.

I NOW intend to take a few of those examples of the mediæval smiths' work which remain in existence, and shall endeavour, in a sketchy manner, to discuss the methods of manufacture adopted. Perhaps the term "manufacture" is not well chosen to express the conditions under which the craftsmen of the Middle Ages gave form and permanence to their beautiful creations—their chastened ideals. Let us say, rather, "methods of fabrication, mysteries of craftsmanship, *chefs d'œuvre* of arts and trades."

In this preliminary section on the work of the mediæval smiths, I think it well to divide the subject under several heads, discussing under each head the characteristics of some special kind of work. In this way I shall take hinges, gates, locks and keys, grilles and screens, arms and armour, and, finally, some miscellaneous pieces of workmanship, as lamps, knockers, etc. But before entering on these, I shall best occupy this present article in remarks of a general character on the methods of operation followed by the old smiths in the fabrication of these various articles.

One of the principles of true art is that of adapting the design to the character of the material employed. Thus, massive designs, which are suitable for stone, are not adapted for works in iron ; and designs, on the other hand, which look well in iron, are not suited to the precious metals. Another principle is that of decorating, instead of disguising and concealing, essential portions of construction. We conceal our locks, hinges, nails, and so forth, as far as possible ; the mediæval workmen elaborated and beautified them, and made their work fit for the vision of the gods.

> In the elder days of art,
> Builders wrought with greatest care
> Each minute and unseen part ;
> For the gods see everywhere.

And thus the early hinges covered the whole breadth of their doors with beauty. The lock and key were marvels of workmanship intended to be seen and admired, and a smith would sometimes occupy two years in making a lock. The nails and bolts were also often richly ornamented.

The old iron work owes much of its charm to one element of beauty, the reason of which we may yet not be quite conscious of—I mean its extreme lightness. It is this which, as much as graceful curves and delicate tracery, lends so much charm to the screens and the grilles, the hinges and the door-fastenings, the gates and the lamp-brackets. The exceeding lightness both in weight and in appearance of work done in wrought iron is one of its chief recommendations. Nothing in stone, timber, or cast iron can be at once so strong and so light, or be endowed with such graceful outlines.

If we examine samples of iron work from different countries and ages, we shall see much difference in the degree of finish imparted to them. But finish alone is not, however, distinctive of any one period, and some of the earlier works compare favourably in this respect with those of later dates.

As a rule, the bars from which the old work is built up are more or less rough. They show the marks of the hammer, and have a wavy and uneven appearance. It

would appear as though the workmen must, in many cases, have themselves hammered their bars to such dimensions as they happened to require for any piece of work on hand. But there are striking exceptions. The best, perhaps, which I have seen is the pair of gates made for Edward IV.'s tomb at Windsor, the reputed work of Quentin Matsys. It is a wonderfully perfect piece of art, and I am at a loss how to account for the smoothness of finish of the surface of the bars. It has been suggested that the heavier portions are of cast iron. It is possible, but very improbable. The art of casting in iron was little understood at the period when these gates were made. I can only think that these are the work of an exceptionally gifted craftsman, and that by the use of a broad flatter, coupled with almost infinite painstaking, the smooth surfaces which are so much admired were imparted to the bars. But certainly the use of flatters by the early smiths appears to have been very much the exception rather than the rule, for few of the main bars upon which the gates are built up, and very little iron work, indeed, of that type, show smooth surfaces.

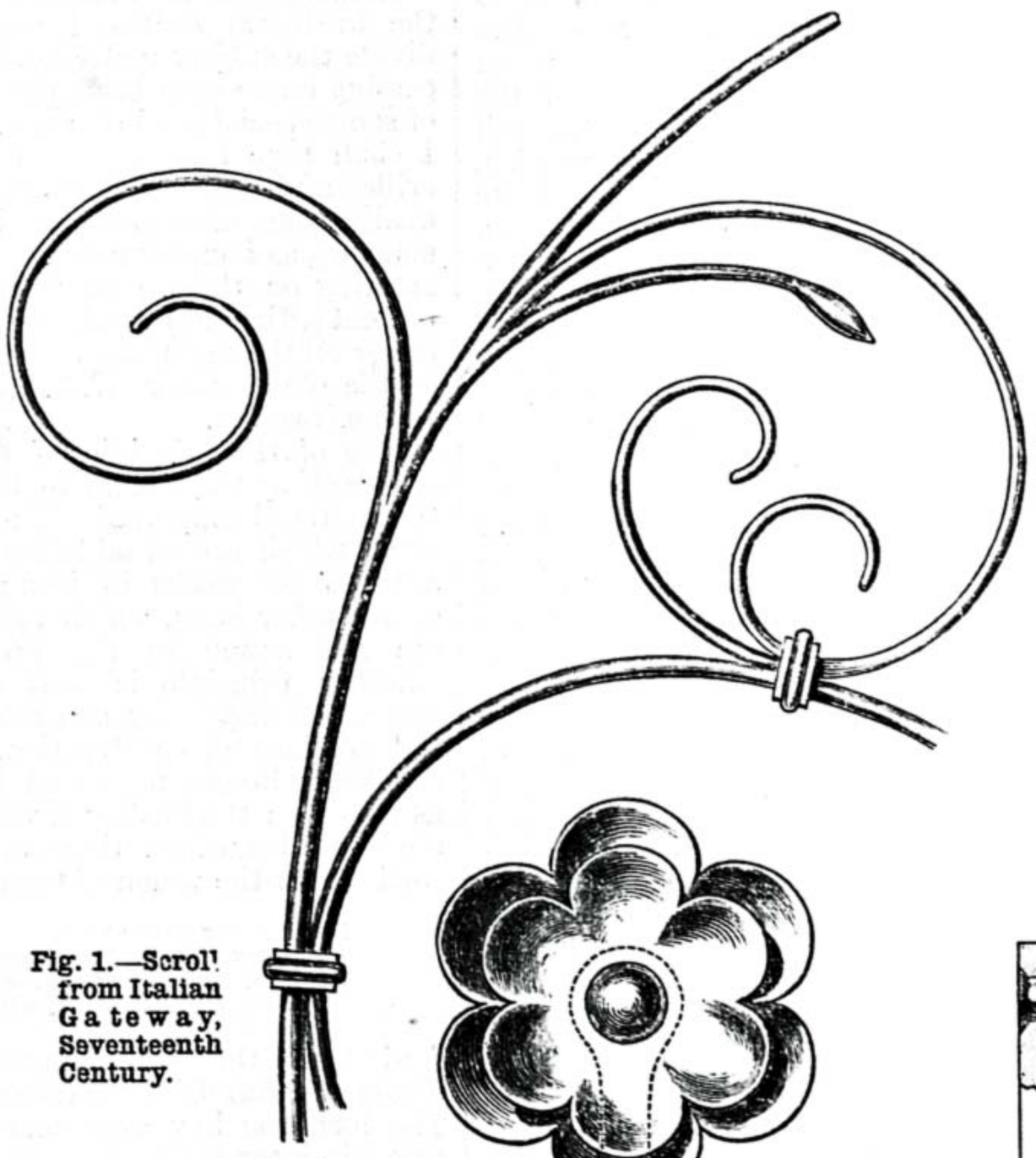


Fig. 1.—Scroll from Italian Gateway, Seventeenth Century.

Another point is that the file seems to have been quite an exceptional tool. Surfaces could have been rendered smooth by a laborious process of filing, but without saying absolutely that this method was not followed, I certainly can detect no traces of its use. There are an immense number of curves whose outlines could have been rendered much more perfect by filing, which were not so rendered. There are many ornamental edges and faces where a file could have been used to much advantage for imparting regularity, symmetry, and finish, where it has certainly never been used; but the work has been, without question, left just as the chisels, punches, or fullering tools left it. Strong evidence that the file was not used is observable in the remarkable freedom from corrosion which these old works manifest, a clear proof, I think, that the work was left untouched after the hammer, the scale of magnetic oxide naturally adherent thereto affording a better protective coating than any paint.

In the union of parts, riveting and tenoning were the principal devices employed in the craft of the mediæval smiths; the main bars are so united, and so also are the delicate foliage and the flowers. The tenons are mostly used for the heavier bars of the framework, and the rivets for the lighter portions. There is little attempt at concealment of these fastenings. Often where the design lends itself thereto the rivets are made subservient to ornament, their heads being formed into a cupped or semicircular shape.

In large numbers of instances the bars and scroll work are united by means of bands or belts of rectangular, oval, or circular outline. This is a method equally common with riveting, and is used in positions where riveting would not be convenient or possible. Illustrations occur in Fig. 1. The bands are variously secured. In very light works they are often simply bent round without any attempt at welding, or even without their ends quite meeting. In many cases, however, they are so close and fast fitting that they appear to be certainly welded. In the larger work they are riveted in two portions. In numerous instances these are made means of ornamentation, the bands being ribbed as in Fig. 1.

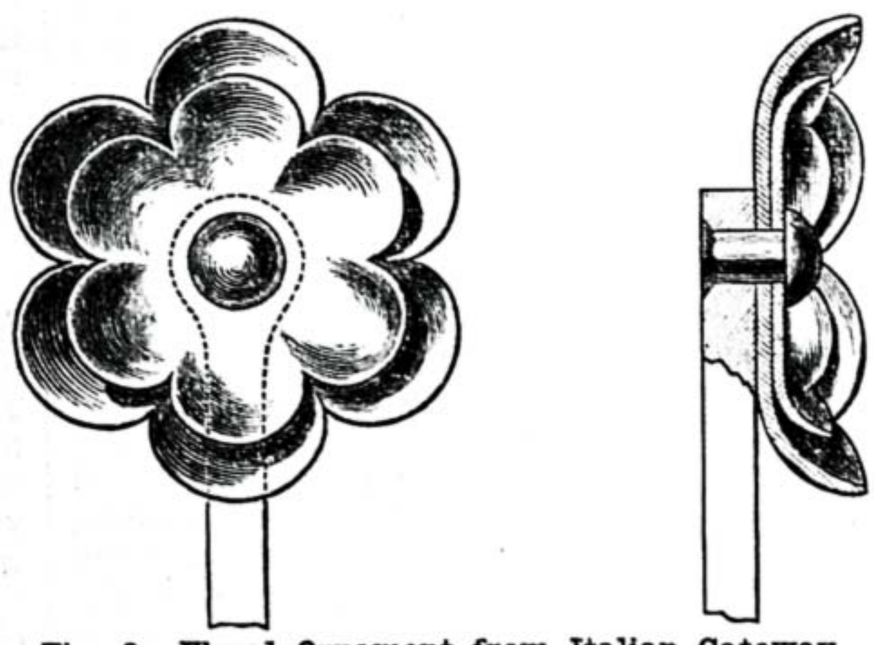


Fig. 2.—Floral Ornament from Italian Gateway, Seventeenth Century.

Another notable feature is that while welding was the exception, swaging down was very common. In large numbers of instances it is quite apparent that a bar of large section has been first taken and bifurcated as many times as there were stems required, and that each of these tongues was then beaten out to required sections, and curved as in Fig. 1, where to all appearance half a dozen separate stems are hammered from a single bar. And expansions made to represent leaves are also often beaten out of the bar. Many stems are of circular section, and it is a difficult task to beat out and curve them also, when, as in many cases, they lie in close contiguity to one another. Even in such work as this, where the inducement to use the file must have been very strong, there is no trace of its employment.

Much of the work of leaves and flowers is convoluted by hammering, the iron being in very many cases not more than $\frac{1}{32}$ in. thick. These leaves are usually riveted on, though also occasionally welded.

The floriated ornament displays much ingenuity, and those who may have ever attempted to hammer, not thin sheet brass, but iron, into floral forms, will appreciate the difficulty of the task. Some specimens of these ornaments are here shown (Figs. 2 and 3). The separate whorls of the corolla, when there are several, are invariably formed of distinct sheets, each cut to outline, and beaten out, and hollowed (see Fig. 2). A torus or base is generally present, and formed by the head of a rivet, which is clenched behind; and this serves to unite the whorls of the corolla to each other, and the whole to the stem as in Fig. 2. Stamens often appear as nails, probably welded in, as they are very firmly set (see Fig. 3). The petals in this illustration appear to have been beaten out of the solid bar. The bar would probably be first divided into five forks, and these beaten into ribbed leaves, which were then bent over.

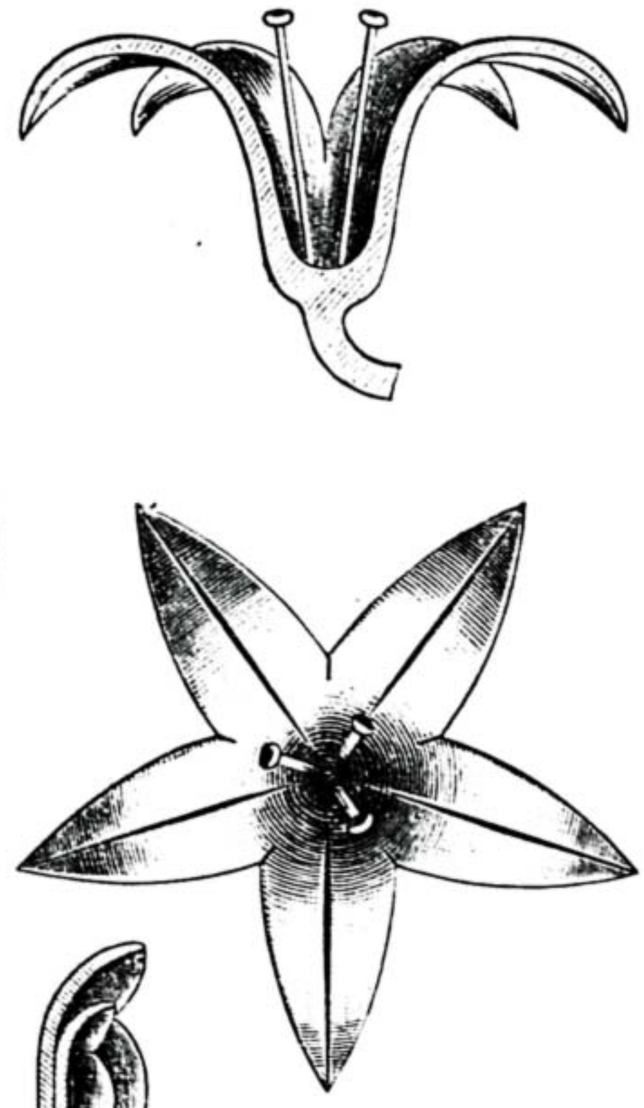


Fig. 3.—Lily, Seventeenth Century.

The beaten foliage is a marked feature of the old work. It conceals many of the unsightly but necessary joints, and much of the plain skeleton of these structures, and the general effect is always pleasing. A candelabrum of hammered iron (Venetian sixteenth century) at South Kensington is thus quite enshrouded with foliage, and this alone catches the casual glance. It is only a close examination that shows the central supporting stem and the scrolls bound thereto, supporting the wealth of foliage. An Italian balustrade (Venetian seventeenth century), also at South Kensington, is entirely formed, save for the top and bottom bars, of cupids and foliage made of hammered iron of about $\frac{1}{32}$ in. thickness, and is made double, the opposed sheets standing out in relief on both sides.

Whatever the method of ornamentation adopted, the secure union of parts is never forgotten. The thin foliage is never without support, usually that of rivets, and the small scrolls and tracery are supported and united at frequent intervals by means of loops or bonds.

The more elaborate scroll work formed from flat bar iron is well worthy of close study. From plain bars of rectangular section the most charming tracery is

constructed. Where practicable several convolutions will be formed from one piece of bar, and the smaller the pattern and the closer and more involved the convolutions the greater is the difficulty of bending them enhanced. Little of this could have been done on the anvil—at least, not in the later stages. Much could have been done with tongs and pincers, or with a light hammer, while the work was laid across suitable mandrels held in the vice. And then where much of the tracery is reproduced over and over again, frequent reference to drawings or templets would have been necessary to verify the accuracy of results.

These works are, to all appearance, done by the hammer chiefly. Yet in some of the grilles and gates there is a profusion of panels whose curves are identical in all respects, and in hinges the curved portions which flank the central bar are beautifully symmetrical on each side. Probably, therefore, templets or full-sized drawings would be employed as now, but for the accuracy of the results the workmen must have trusted only to hammer and tongs.

Nor is this all. In the gates and grilles there are mouldings of diverse forms attached to plain bars or frames. We can roll moulded forms between grooved rollers. Not so the old smiths. These mouldings must have been laboriously first chamfered roughly, and then swaged down bit by bit between swages or moulds or dies first carefully prepared. The quantity of material required precludes the likelihood of any other method of formation having been adopted. To these mouldings, and their mode of fabrication, I shall give more detailed notice.

How beautiful were many of these creations! Though the execution of the work is often rude and rough if tested by our modern standard of machine finish and of die-stamping, with their monotonous regularity, yet beauty is interwoven with them all, and the more we study them the greater is the fascination, the more intense the spell of reverence and delight with which we are held in bondage. Though the blacksmith's work is not gaudy, like that of the gold and silver-smith's, or even as that of the brass founder and copper-smith, it still partakes of, and is permeated with, the charm that in some mysterious way is ever associated with the stormy ages when art, science, and learning found an ark of safety within the walls of the cloister, and in the service of the Church.

NEWSPAPER CUTTINGS: HOW TO KEEP THEM.

BY "A COLLECTOR."

NEWSPAPERS and magazines contain so many articles of interest to an intelligent workman that it seems a shame that they should in so many cases be consigned to waste and destroyed after being once read. It is true, some of the magazines dealing with subjects of special interest are preserved and bound at the completion of the volume; but I refer more particularly to those odd items of information and practical use which are continually to be found in the daily and weekly newspapers. In as few words as possible I will explain my method of preserving these and arranging them for reference. It is, of course, possible to find other methods which may have advantages in the ease of classifying and finding the cuttings, but, as a rule, they are more cumbrous, and necessitate the use of more drawers or pigeon holes than most of us can command. After an experience of fifteen years, I believe the method I am about to describe will be found to be the most serviceable.

First of all, then, when you read, read with a lead pencil within reach, and mark everything that you want to keep. Don't be afraid of marking, thinking that you can

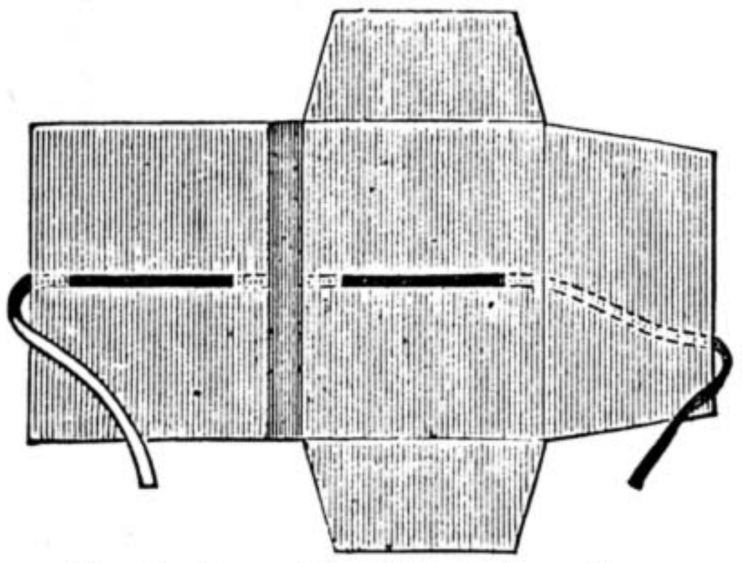


Fig. 1.—Paper Mounted to form Case.

trust to your memory for a certain fact or recipe; when you want it most you will possibly find that your memory is at fault in just some little detail which is of the greatest importance; and remember that it is the man who can lay his hands at once on the information he needs who has the best chance of success nowadays. Mark, then, anything likely to be useful to you. When read put your paper away where it will not be destroyed, and at the week end or first leisure half-hour, take a pair of scissors, light your pipe, and proceed to cut out everything you have marked. Paste these cuttings, either just as they come to hand or,

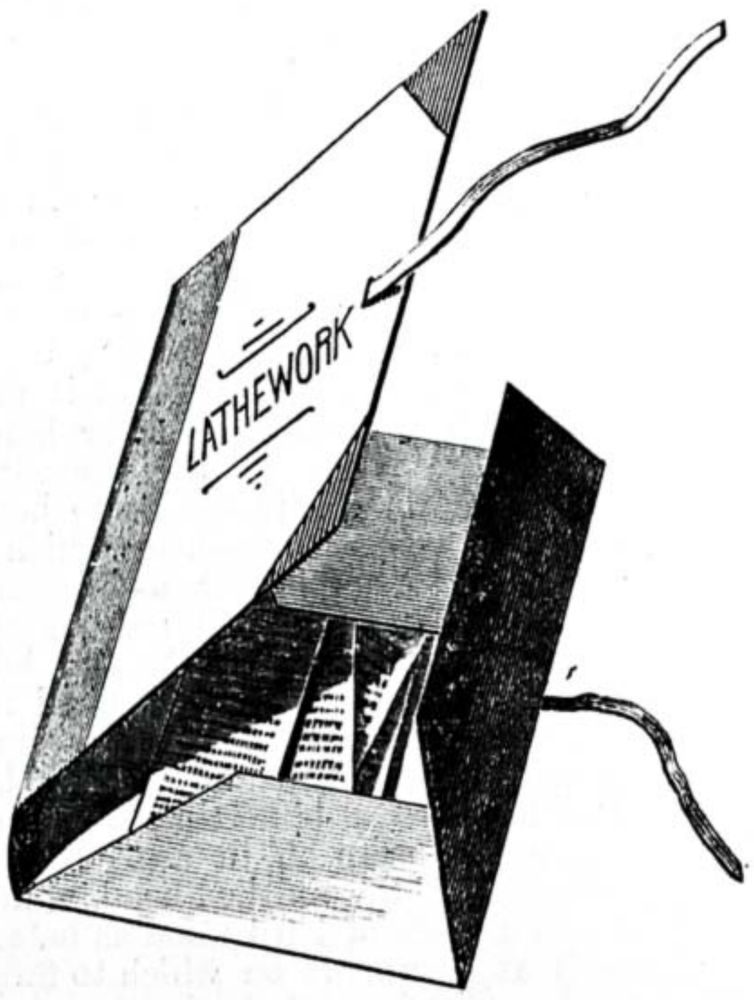


Fig. 2.—Case for Cuttings Complete.

if you have much sense of order, classified as far as you can, into a scrap-book with numbered pages. Those that I use myself are the "Newspaper Cuttings," issued by Messrs. Marcus Ward & Co., and contain two hundred pages each, though smaller ones are to be had. Now then prepare an index in a separate note-book. There is an index in the cutting books named above, but generally it will be found not to have room enough for the requisite entries. Do not skimp your index; make it big enough to last a lifetime, for if you once start it you are not likely to drop it again. Get a good thick note-book, at least an inch thick, and at the top corners of every page place initial letters. It will be found convenient to use the system adopted by accountants in indexing ledgers and other account books; that is, to classify the entries by the first letter and also by the first vowel after the first letter. Thus, "Fretwork" would be indexed on the page devoted to "Fe," "Bridges" under "Bi." Count the pages in your note-book, and then divide them equally amongst the letters of the alphabet, commencing with, say, five pages (or the number found necessary) lettered "Aa;" then following on with Ae, Ai, Ao, and Au. B follows with Ba, Be, etc. This index serves to enter the subjects of all your scraps; and, more than that, any article which you may meet with in your reading should be indexed under its proper heading in such a manner that the book or magazine can be referred to at any future time. The "Newspaper Cutting" books can be referred to as "Sc. I.," or "Sc. II.," signifying Scrap-book I. or II., with the number of the page in smaller figures; while bound books or magazines should have the title and other particulars given more fully. The following examples from my index may make this a little clearer:—

Architecture: Law Court Designs, "Belgravia," Vol. II.; "Builder," end of 1884.
Automata: "Household Words," Vol. IV., 503; "Leisure Hour," 1879.
Foundations: Sc. VIII., 42.
Keyways: Proportions of; Sc. I., 4.

Wherever necessary the item should be indexed under several headings; as, for example, an article on the "Progress of the Manchester Ship Canal," should be referred to under M. S. and C., and *not* under "Progress." I am sorry to say that a valuable weekly journal destroys half the value of its contents by its poverty of indexing, the above item being found only under "Progress," where one would certainly never look for it; while "How to make Glue" is indexed under "How," and never mentioned under "Glue."

The above contains in brief the whole system, and I think I am safe in saying that any one who has tried it for six months will find it of so much use as to be very unwilling to give it up. Sometimes the cuttings relating to one subject will be found to be very long and very numerous. To put these in the scrap-book would be inconvenient for several reasons—they take up too much valuable room, too much time in pasting in, and they get too much separated by other matter coming in between. The plan I use in dealing with these is to make a separate case for each subject, by cutting and folding old mounted drawing paper, as shown in the diagrams. This material I use because it comes most readily to my hands, but if it is not obtainable there will be no difficulty in finding a substitute. The mounted paper is cut to the shape shown in Fig. 1, and folded with the holland side outwards. A piece of red tape, such as is used for bundling papers, is threaded through as shown, and a strip of dark-coloured bookbinder's cloth, glued along the back, serves to keep the tape in position and make the case presentable when put on the bookshelves. With pen and ink print the title on the front cover, as in Fig. 2, and draw the marks across the corners, and the thing is complete. It takes ten minutes to make, does not cost more than twopence at the most, and has quite a respectable appearance.

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

THE CASE AND INTERIOR MECHANISM OF THE COMPOUND KALEIDOSCOPE.

[*For Illustrations to which References are made in this Paper, see pages* 424, 425.]

HAVING completed the wood turning in connection with the plates forming the ends of the case, the next process is that of cutting out the plates to the correct form: first, square the centre lines across the edges, and continue them on the reverse side; then set out the octagon on the front plate, and having removed some of the surplus wood with a saw, pare off the remainder to the lines, keeping the edge as square as possible. The two plates, with the insides facing each other, must now be attached together by a couple of screws passing through on a line perpendicular to M N (Fig. 2), and 3¼ in. from the centre, so as not to disfigure the wood where exposed to view. When fixing, be mindful to notice that the centre lines correspond, and also, that the opening in the front plate is concentric with the circle of the same diameter scribed on the back plate, which may now be pared round the edges to match the front, and a ¼-in. hole bored squarely through the two plates corresponding to the centre of the milled head, E (Fig. 1); this hole requires slotting in the front plate, but may be deferred till the spindle has been prepared.

The plates can now be taken asunder, and a start made on the metal work. Turning to O (Fig. 2), a brass plate is shown, having a hole in the centre, in which the pinion turns, to which the milled head, C, is attached, and on each side of the central hole a slot is cut in which slide the ends of two steel rods supporting the arms, K, K (Fig. 5). These slotted plates are cut from sheet brass ⅛ in. thick, 6½ in. long, and 1⅛ in. wide; notice if they are winding, or bent; if so, lay them on a level surface, and remove the twist with a few skilful blows of a smooth-faced hammer. Drill and countersink the holes for the screws, which may be ¼ or ⅜ in. long, and attach them side by side to the true face of a piece of hard wood. Holding them thus in the vice, file the surface quite level, heat a soldering iron, and tin the ends of each piece; now lay them face to face, bind them together with a piece of fine iron wire, and using sprits of salts for a flux, sweat them together with a heavy piece of red-hot iron. When cold, level both sides, and one edge as straight and square as possible, then the other parallel to it. Scribe a centre line on one face, and dot the central hole with a fine pointed centre-punch; on each side of this dot set off 13/16 in. with the compasses; dot these marks for holes denoting the inner ends of the slots, and a second pair of dots 6 in. apart for the outer ends, after which the slots may be spaced out for drilling a series of holes 3/16 in. apart; the drill used for the purpose should be about 1/32 in. less in diameter than the width of the finished slot. A twist drill mounted in the lathe will be found the most suitable tool for the work, the plates being fed on the drill by means of a piece of hard wood having a deep hole previously bored in the lathe to fit tightly over the centre of the sliding headstock. The dots will probably require to be deepened to prevent the drill from wandering. A line may now be gauged on each side of the row of holes, the distance between not to exceed the diameter of the steel rods. By a careful use of a fine rat-tail file, the holes may be run into each other; then a stout ward file for roughing, and using a dead smooth for the finishing touches. Drill the central hole ⅛ in. diameter, and leave it to be finished with a reamer. On applying heat, the two plates will separate, and they may now be secured in their places immediately over the centre line, I J (Fig. 2). It is now necessary to prepare the milled heads, B and D (Fig. 5), which act as lock-nuts on the screws cut on the heads, A and C. Of course, the easiest method would be to hold them by means of a self-centring chuck, but failing this, they may be held for turning by driving them tightly into a recess bored in a piece of hard wood which has been mounted on a face plate. If a good fit is secured, it will be found unnecessary to sink them beyond half their depth. Having trued up one side, bore a 5/16-in. hole in the centre for screwing with the ⅜-in. brass gas tap. To make sure that it is truly tapped it will be well to enter the taper tap a little way before removing from the chuck, feeding up the back centre as the tap moves inwards, the screwing to be finished in the vice. Each head having been treated in this way, they must be mounted on a suitable mandrel of brass or iron, and the turning completed, finishing the edges by grooving and milling. The heads, A and C, require much the same treatment as the foregoing. They are mounted first with the shanks projecting; should they exhibit a tendency to become loose in the chuck, they may be further secured with three wood screws, evenly disposed round the edge of the recess, or the back centre may be pressed into the service to assist in steadying the shank while it is being manipulated. A hole 3/32 in. diameter is next drilled and tapered as shown with a suitable reamer. Should the latter not be to hand, procure a piece of ¼-in. cast steel about 4 in. long, anneal it by heating to a dull red, and place it in slaked lime to cool. File about ¾ in. at one end, square in section, so that it may be turned with a small wrench or brace, then reduce the point to the necessary taper, making it circular in section to begin with, and afterwards pentagonal, which is not so difficult to accomplish as it seems at first sight. Now make it red-hot and plunge into cold water, polish, and hold it over a thick piece of hot iron until the cutting portion becomes of a deep straw colour; cool this portion and still further lower the head to a blue tint, otherwise it will be apt to snap off in use. It now remains to mount the finished head, B, firm and deep in a piece of hard wood as before, and use it as a support on which to finish the outsides and edges of the heads, A and C, after which, rather than resort to force, it will be well to split up the wood in which the former is embedded.

The next in order is the stationary pinion; first, square up the ends of the brass tube to finish 7⅛ in. long; it is possible to do this with a file, but a superior way is to turn them, fitting a short piece of iron into the end to support the tube lest it collapse under the screw of the carrier, which latter should be small, and may be easily made out of a piece of brass plate ¼ in. thick, having a screw ⅛ in. diameter. The tube is then trued up at one end, and the opposite end next the carrier separated with a thin parting tool. Should the tube prove too short to admit the carrier as above, use thicker iron, with a shoulder to abut against the end of the tube. Now cut off 5 in. of pinion wire, centre it truly at both ends, and turn about an inch at one end, to fit tightly within the brass tube; set off ⅜ in. from the shoulder, and beyond this turn a bearing large enough in diameter to allow of the central hole in the slotted plate for which it is intended being broached out to fit it. Leaving fully ⅛ in. for the bearing beyond this, cut a notch with the edge of a small half round file and break it asunder; centre afresh, and turn the remaining portion to fit the opposite end of the tube for about 1½ in.; then ⅜ in. set off as before, and from this point it is turned parallel for ½ in., after which the remainder is tapered to fit the milled head, C. If the worker is an adept with the file, the leaves of the pinion wire may be so reduced as to leave very little to be done in the lathe, and thus avoid the jarring of the work as the tool meets each leaf or tooth in succession; in any case, it will be advisable to make a somewhat liberal use of the file, always provided that the process is not carried too far. The pinion to which the head, A, is attached is similar to that just described, and slides in vertical slots cut in two brass plates 2⅜ in. long and 1⅛ in. wide; the upper ends are cut to the angle of the case to which they are secured by four screws each. The outline of one half is shown in elevation by the dotted line at P (Fig. 2), and they are also shown in section just behind the racks in Fig. 5. The slots must be polished so that the pinion works freely and smoothly within them, and the plates carefully attached to the woodwork, the centre of the slots coincident with the centre line, M N; of course, the wood must be pierced squarely through to admit the tapering ends of the pinions, and for the parallel necks or journals of these latter, four washers must be prepared; all are circular in section, with the exception of that under the clamping head, B (Fig. 5). The washer in question is an oblong plate curved at the top and square at the bottom end, in order to utilise it as a vernier to indicate the angle of the reflectors; it is kept vertical by a long slot, which slides on a pin formed of a small screw, the head being filed off flush after being screwed home. The plate adjacent to the slide may also be attached at this juncture, the figures being deferred for the present, as their correct position can only be determined by experiment when the instrument is complete.

Having proceeded thus far, we may now turn our attention to the spindle connected to the friction wheel, H (Figs. 2 and 5). There are two methods whereby this may be accomplished; the first which suggests itself is to bore a hole in a hard piece of beech ⅝ in. thick, so that a No. 18 wood-screw will fit tightly within it; wind the screw, which should be about 4 in. long, to the end of the thread, and cut off the point ⅛ in. outside the wood; unwind the screw, and weld or braze it to a piece of 5/16 in. round iron, cut off to 9½ in. from the screw-thread; straighten and centre accurately, then replace the wood disc, and finish to 1⅞ in. diameter by ½ in. thick, a very shallow groove being turned on the edge to support a band of red rubber, as sold by stationers to secure note books. Inserting a small screw in the rim of the disc, we may use it for a carrier to reduce the opposite end of the spindle to fit the milled head, E

(Fig. 1), which has been prepared with a tapering hole for its reception. Perhaps an easier way to mount the spindle would be to reduce the plain part of the wood-screw so as to fit a piece of $\frac{5}{16}$-in. brass tube, 9 in. long, and also reducing the long boss or shank of the milled head to fit the opposite end, securing them in position by sweating together, or drilling a small hole for a pin; though sweating is to be used in preference. By using the brass tube for the spindle, we shall gain an advantage in its being shorter, and thus lessen the distance that the head projects outwards from the case. Selecting a piece of brass $\frac{1}{8}$ in. thick, we may now cut out the lever, L (Fig. 2), as shown in the dotted line; it is attached by a screw at its lower end, which acts as a fulcrum. The central hole is broached out to fit the spindle, which has a groove cut $\frac{1}{8}$ in. wide at this point, the lever acting as a key to prevent end-shake, and at the upper end of the lever is a small stud, round which is hooked one end of a tension spring, the opposite end of which is secured by a screw, and the slotted plate, P, cut away to clear it.

Arrived at this stage, it is now necessary to commence on the rackwork. First attacking the fixed pair, R R (Fig. 5), very little difficulty is likely to be experienced in making them a success. Two pieces of rackwork $2\frac{1}{4}$ in. long are cut off, and at each end the teeth are removed, so as to leave a clear space of $\frac{3}{8}$ in.; in the centre of this space a hole is drilled and countersunk for small screws, by which the racks are secured to pieces of oak or beech, shaped as at o (Fig. 2); these are rabbeted to fit over the slotted plates, and it will be noticed that one is $\frac{1}{8}$ in. thicker than the other, and is also cut away in addition to admit of vertical travel in the washer, which resists the pull of the clamping head, B. Passing on to the sliding racks, S, S (Fig. 5), we require for these two lengths of dry beech, 12 in. long, accurately planed true and parallel to $\frac{3}{8}$ in. square. Previous to being divided into 6 in. lengths, mark one face and one edge, and place some distinguishing mark so that they may be kept in pairs, one pair to each end. As only $4\frac{1}{2}$ in. are useful, I must explain that the extra length is to lessen the danger of the wood splitting on account of having to drive screws in close proximity to the end of the piece. The two remaining lengths of rackwork are equally divided, and a space cleared and drilled at each end as before, after which each rack is screwed to a wood slide in the centre of its length and flush with the face. As in the case of the fixed rack above, provision must be made for the washer, and in order to support the rack, and keep it square with the pinion, a slip of wood about $\frac{1}{8}$ in. thick is screwed to the back of the slide, as shown in section Fig. 5; when these are in position, they should slide just clear of the edge of the slotted plate. Now, it will be seen that the lower slide of the two at each end is supported on a piece of hard wood, T, T, $2\frac{1}{2}$ in. long, 1 in. wide, and the combined thickness of the slide and slotted plate in one instance, with the washer added in the other. The exact position of these supports may be found by placing the end of the case on the bench, inside uppermost, and holding the pinion vertically in its bearing; push the lower rack into position, interposing a slip of writing paper, so that the teeth may not engage too deeply, the support being finally secured with a screw at $\frac{1}{2}$ in. from each end, thus clearing the brass clips, *l l* (Fig. 5), which grasp the backs of the upper slides. These clips are of brass $\frac{1}{8}$ in. thick, filed to the outline seen in the dotted line (Fig. 2), allowing $\frac{1}{2}$ in. beyond for bending. If the brass from which they are to be made betrays a disposition to crack on bending to a sharp angle, it must be annealed by making red hot, and plunging into cold water. The hole is first drilled to clear the pinion, then the latter is placed upright, the paper slips intervening between the racks and pinion teeth, and a line scribed on the inside of the brass clip, which must next be bent at a right angle, over the edge of a piece of smooth $\frac{1}{2}$-in. square iron, bent on itself, in order to grasp the brass on both sides when held in the vice. This done, with a smooth file polish the inside of each clip, rounding off the arris or edge so far as it comes in contact with the wood slides. When all this has been carefully carried out, it will be found that the racks will travel smoothly in either direction on turning the pinion with a small carrier or pin vice. Should this not have the desired effect, one or both the racks is too deeply in gear with the pinion, if they are not pinched at the sides. Taking them asunder for examination, it will perhaps be discovered that the cause lies in their not being of an even thickness from the tips of the teeth to the back, which will be exemplified by a careful use of the calipers; the remedy will be to file a little off the wood, preserving the same square edge, but on no account must the teeth be interfered with. If the calipers reveal no discrepancy in the depth, it may be necessary to remove the brass clip and file the surface adjacent to the slides, only be mindful that a very little clearance will give the necessary freedom to the movement. The rackwork is now complete, with the exception of four brass lugs or hinges $\frac{1}{8}$ in. thick, as seen at *k* (Fig. 1), having holes drilled and broached if necessary to fit the steel rods which pass through the arms of the reflectors. To be certain that this hole is exactly central over the slot in which the rod moves, it will be advisable to bring the racks to the end of the stroke, as in Fig. 2, while the holes for the screws are being marked through the countersunk holes in the hinges. In this way it will be immediately noticed if the pinion is out of wind with the rod on each side of it. The surplus wood at the ends of the slides may now be cut away, the lower slides being bevelled as at s (Fig. 1), to clear the sides of the case, the construction of which will be taken up in the next article.

DESIGN FOR A LARGE BRACKET IN FRETWORK.

BY E. BONNEY STEYNE.

FRET-CRAFT is an art so simple, that the rules for its perfect working might be taught in five minutes and set forth in a few paragraphs. Yet the point where it gains value from careful and precise workmanship is not to be reached by one or two trials only. If, however, the amateur worker intends to become a past master of the craft, the motto of the old Romans—*Festina lente*—which is generally translated "hasten slowly," should be his, for undue dilatoriness or overhaste will alike fail to compass his end. Like to a moth fretting against a garment, he will indeed leave traces behind him, not only of spoilt material, but also of useless toil. If the saw is not tight and taut at each reinsertion—if it be not held in a perfectly vertical position—the best result cannot be achieved. Yet, if the design is only wrought with elaborate mechanical exactitude, there is danger of a stiff cast-iron pattern being produced. In all hand-wrought work, the charm consists in the feeling unwittingly imparted by the worker. A machine will make you ten thousand repeats of the same detail with microscopic correctness, but if an artist has to draw a pattern with frequent repetitions, though he be never so careful, he will, if indeed he be an artist, all unknowingly produce slight variations in each.

The leaves of a tree, like as they are to each other, are yet not exact replicas of one shape, even in the simplest formed species. But it is waste of words to try to teach what must be instinctive. Though you argue until doomsday, you shall never convince one who has not already felt it of the subtle quality we call "art." Be sure, that if you fail to recognise the difference between things held to be worthy, and the commonplace wares of to-day, that the joy or sorrow of the artist is not yours. If you see nothing in the marvellous drapery of the Fates (in the marble remains of the frieze of the Parthenon in the British Museum) more than in the drapery also of marble that clothes the weeping figures who are fondling urns in the Euston Road stoneyards, then it would be waste of time to try to instil it. To be able to explain wherein and why they differ is quite another thing, that comes only by education and study, but the feeling must be there ere you can in any way cultivate it.

If you take rough carvings by peasant lads, home-made attempts at decoration by artisans, in some you trace the untrained artist, in others merely the mechanic, who assuredly may rival a machine in his finish, but who will never surpass it in the higher qualities.

A sombre sermon this, you say, on a fretwork bracket. Diluted philosophy expended on a trivial piece of ornamental work, lacking merit in design, and exacting little skill in execution. True, I grant you; but the preacher may be aware of the good, although his infirmities forbid him to achieve it. And if the desire to be inspired with the true and sincere love of beauty for its own sake should begin with a thing that has no claim whatever to such a royal description, it will have served a noble end. If in poor work you put your whole heart into making each curve better than your design, letting every leaf or bud mimic the true lines of nature, which, in the desire to keep the whole simple, is impossible in catering for an unknown army of possible workers, then the artist who drew it on paper will be only too delighted to find himself beaten, and be glad to have provoked the energy that caused the initial effort.

The design, for the necessity of the pages of WORK, has been planned to give a large pattern in the limit of a page. In tracing leave half an inch of plain wood between the four parts. Trace and reverse for the second tracing of each part. The bracket to support the shelf can be either a simple one or the whole of design A. The shelf may be shaped to any convenient form. It is best kept square with rounded corners. This yields more room for objects to be carried, and is better than a simple half circle.

The size of the bracket when finished and put together is 17 in. by $15\frac{1}{2}$ in. There is no necessity to say anything about material, as when it is possible to do so the material should be suited to the furniture of the room and the surroundings. The design itself will be found in the next page.

A

Full-Size Design

FOR A

Bracket

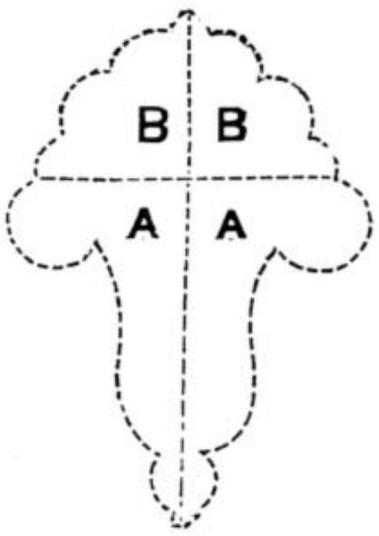
IN

Fretwork.

(Size, 17 in. by 15½ in.)

BY

E. BONNEY STEYNE.



B

A

BURGLAR ALARUMS.

BY GEORGE EDWINSON BONNEY.

THE WILY BURGLAR—UNGUARDED POINTS OF THE DEFENCE — BURGLAR TRAPS — LEADBETTER'S BURGLAR ALARM—FLOOR OR DOOR-MAT CONTACT—AMATEUR FLOOR CONTACT ALARM—CLOSED CIRCUIT ALARM SYSTEM — ALARUMS FOR EMPTY HOUSES—CONCLUSION.

The Wily Burglar.—Professional burglars do not always set about their nefarious work in the same way, nor enter the house according to the rules of any concerted system. An open window or open door may generally be relied upon as offering an unresistable temptation to the thief, but he prefers an open cellar grating, a fan-light left unfastened, or scullery window left ajar, to any of these apparent traps. The old bird is not caught with chaff, nor the ticket-of-leave man twice in the same way. As he gets older in his career, he becomes more crafty, and teaches the younger members of his profession the mysteries of his craft. I can quite conceive of such a wily thief studying electricity and making himself well acquainted with electric burglar alarms with a view to turning his acquisitions of knowledge to his own ends. Such a wily thief would examine all windows and doors in search of indications pointing to the presence of alarm contacts, and even invent means for throwing these out of action and so prevent them from giving the alarm.

Unguarded Points of the Defence.—We should therefore endeavour to so plan our system of defence as to leave no points unguarded. Partially opened fanlights may be left in this state if protected with Legge's Window Blind Contact. Scullery windows should always be fitted with a suitable contact, and even the trap-door leading to the roof should not be left unguarded. The cellar-flap or grating may be adequately protected with one of Dale's Burglar Traps fastened to the same with a piece of stout string. Should the thief break the fastenings of the flap noiselessly and attempt to open it, the string of the trap will not fail to ring the bell; and should he discover the string and cut it, he will by so doing release the spring of the trap and cause it to make contact.

Burglar Traps.—These, and the others to be described, are therefore veritable burglar traps, likely to foil the most cunningly devised schemes of the wily burglar, and drive him to despair. Dale's Burglar Trap (shown at Fig. 60) is so named by me because of its cleverly devised double action. This trap is made up (as shown in the figure) of a small brass casting 3½ in. by ⅝ in. by ⅛ in., with two pieces bent down in the middle at right angles to form a clasp for the hinged lever below. An ebonite block is attached to each end of the base plate, and to these blocks are fixed brass contact pieces insulated from the base plate. The small brass rocking lever hinged to the base plate is also furnished with platinum points where the ends touch the contact plates. It will be seen that a piece of bent clock spring, D, forms a spring between the base plate and one end of the rocking lever, to keep this from being in contact with the plate at A. This little appliance may be attached by screws to the floor, a post, or any piece of wood at a little distance from the point to be protected. The wire from the binding screw, C, must then be connected to one line wire, and the two wires from A and B to the other line wire of the alarum system. This being done, the bell will ring and continue ringing until the

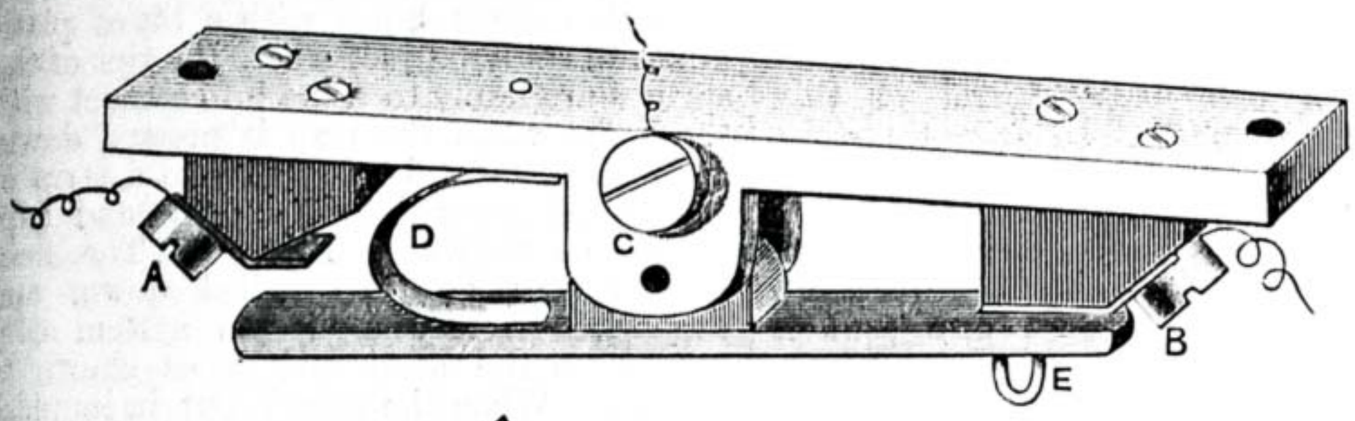


Fig. 60. — Dale's Burglar Trap.

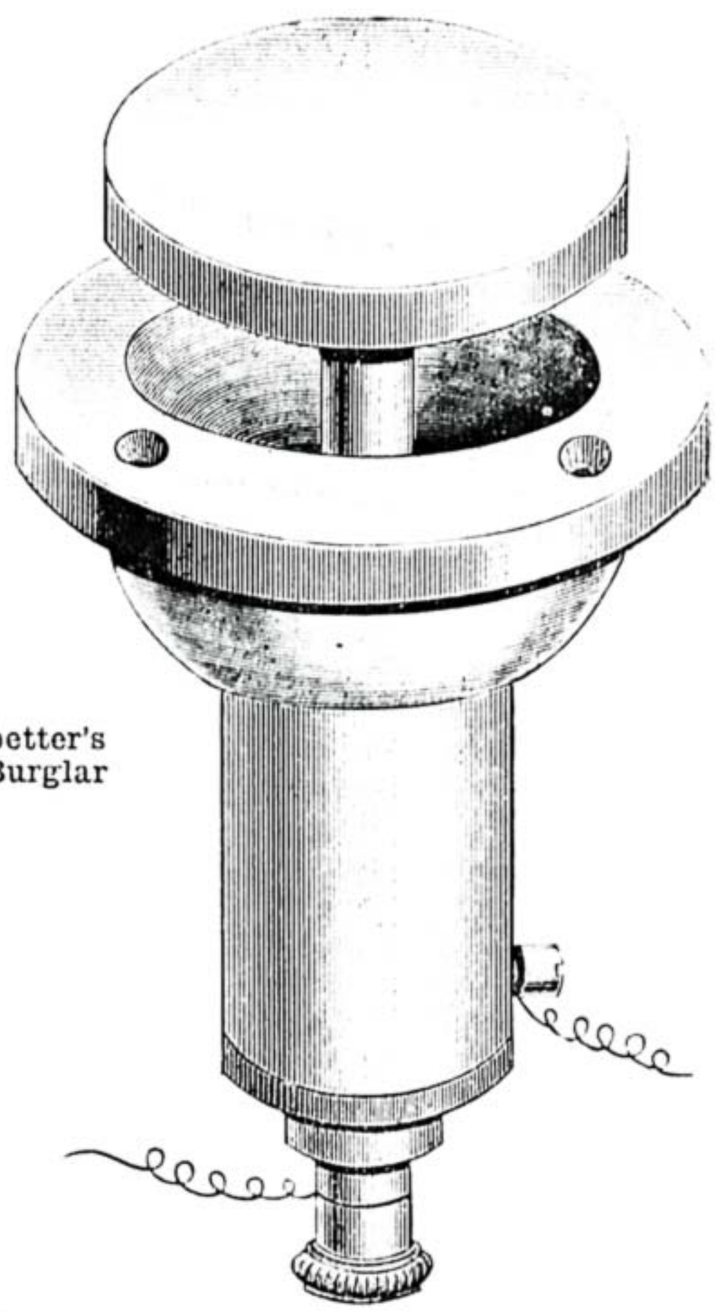


Fig. 61. — Leadbetter's Universal Burglar Alarm.

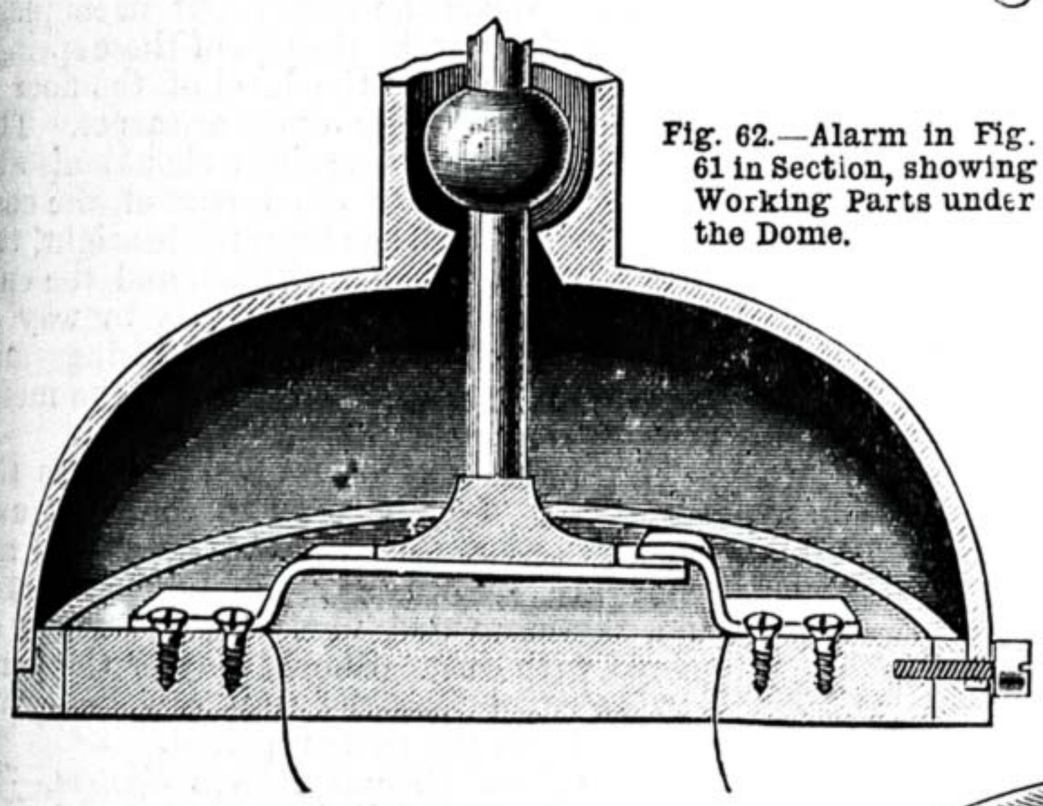
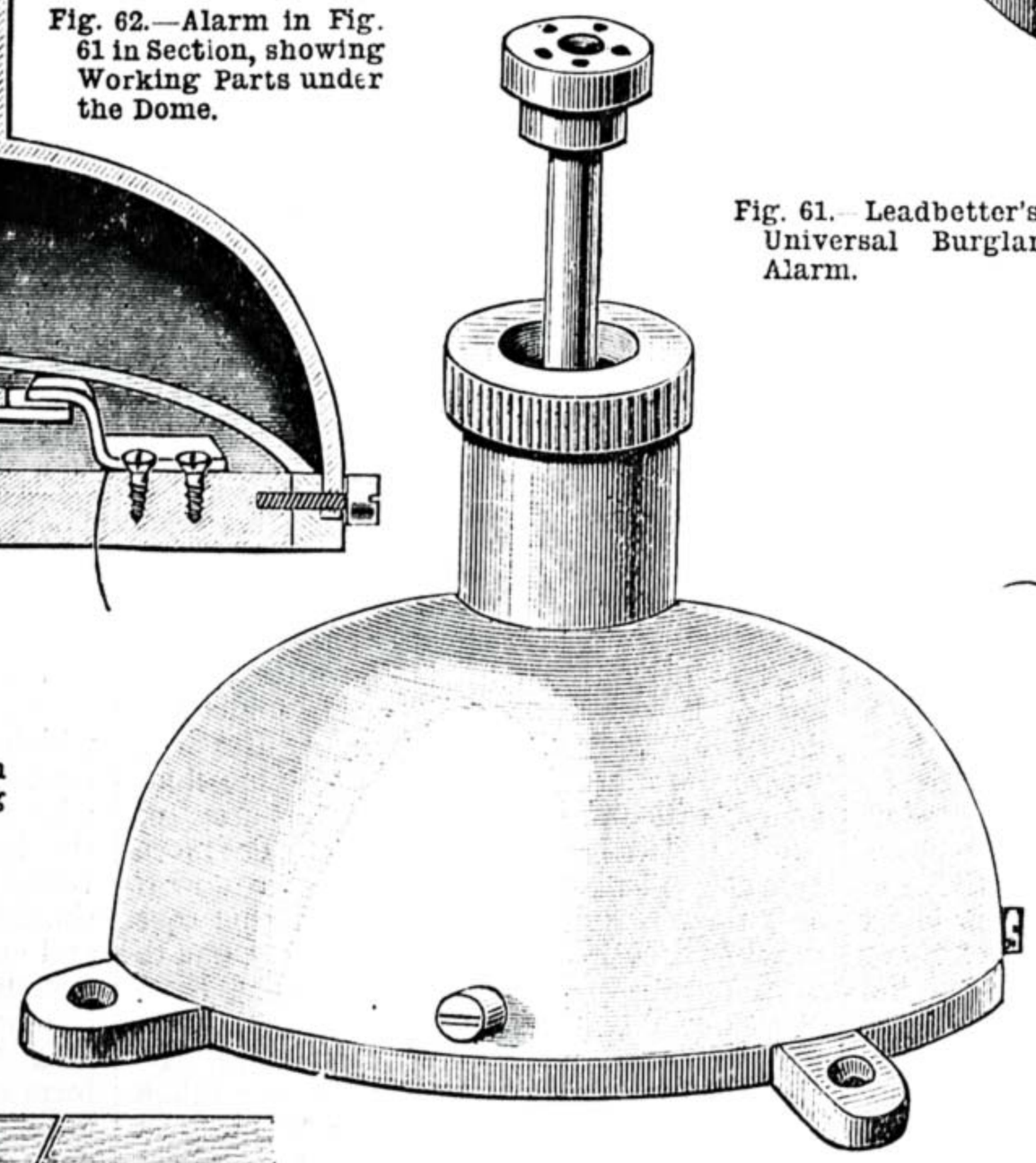


Fig. 62.—Alarm in Fig. 61 in Section, showing Working Parts under the Dome.



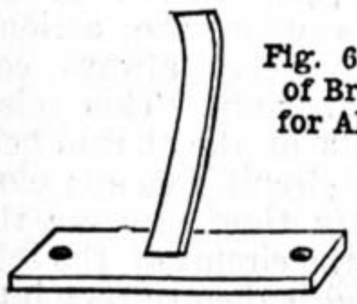


Fig. 65. — Form of Brass Spring for Alarm.

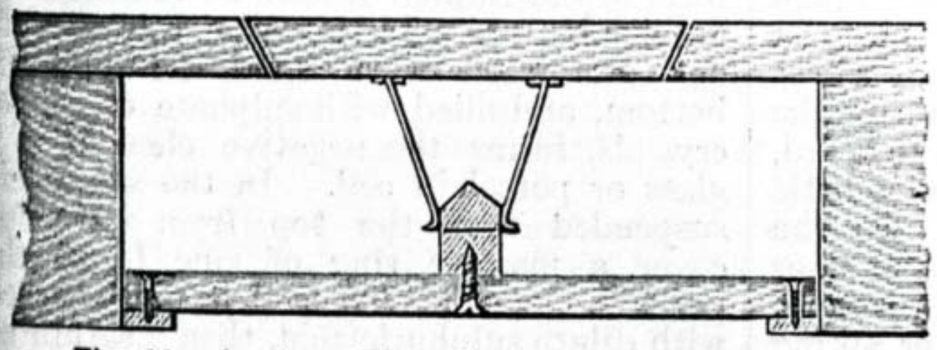


Fig. 66.—Amateur Floor Contact Alarm: Section.

Fig. 67.—Contact Block for Floor Contact Alarm.

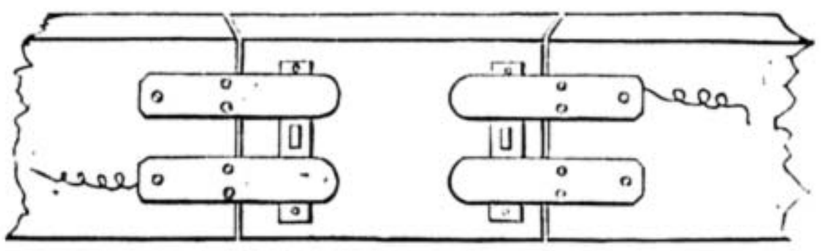


Fig. 64.—Amateur Floor Contact Alarm: Plan of Underside.

Fig. 63.—Floor or Door-Mat Contact.

rocking lever has been pulled away from B sufficient to keep both ends free from touching either A or B. A piece of stout string is then fastened to the loop, E, and tied to the door-flap, grating, drawer, or whatever we wish to protect. It may be tied to the leg of the table, or of a chair, or to the knob of a drawer, or of a door. Should the article to which it is tied be moved away from the appliance, the lever will be brought into contact with A and start the bell ringing; but should the wily thief discover and cut the string, the lever will be forced by the spring, D, into contact with B, and thus ring the bell. Should he fail to discover the string, he may possibly stumble against it and thus bring both ends alternately in contact. Similar traps are made in cylindrical form for insertion in posts and sills. In these forms a small brass piston working in an ebonite cylinder is kept in contact with the brass casing at one end by means of a spiral spring, until pulled out, when a cross piece makes contact at the other end. These are named "double contacts."

Leadbetter's Burglar Alarm.—This ingenious burglar trap, invented by Major Leadbetter, is shown at Fig. 61, and its internal arrangement at Fig. 62. The external appearance is that of a 3-in. electric bell gong, furnished with a pillar on the top, out of which protrudes a small piston of brass. On taking this instrument in hand we find that the gong is fastened to a brass ring enclosing a disc of ebonite, which forms a base for the gong. The ring is held to the sides of the gong by three small steel set screws, and, on unscrewing these, the dome comes off and reveals the interior arrangement shown in section at Fig. 62. This is most simple. Two small strips of spring brass are fixed to the ebonite base by small screws and bent to form a bridge, coming into contact with each other at the free ends. To the longer and lower strip is soldered (in the middle of the bridge) a small disc of brass raised in the centre to form a cone, the summit of which is hollowed out a little to receive the rounded end of the brass rod or piston. Two short pieces of insulated wire connected to these bits of brass and carried out through holes in the ebonite base, serve to connect them with the alarum system ouside. It will be seen that the pillar on the top of the gong is hollowed out to form a socket, and this fits a ball through which the piston passes. The screwed cap of the pillar is hollowed beneath to form a cup fitting the top of this ball. When, therefore, the end of the rod or piston is inserted in the top of the cone on the contact bridge and the cap of the pillar is screwed down, its hollow cup presses on the ball and causes the rod to press apart the contact pieces below. The alarum is now fixed ready for action. By means of projecting pieces on the ring of the base, it may be fastened by screws to the floor of a room, to a block of wood in a garden, or to a table, or any other wooden support. Pieces of twine or strong worsted are then fastened to the top of the piston (in the holes shown in the cap) and led in any direction from the contact to doors or windows, or to stakes driven in the ground, to which the ends must be attached. If the prowling thief opens a door attached to one of these strings, or if his feet is caught in one of them, the top of the projecting rod is pulled on one side and its foot slips out of the socket on to the contact bridge; these strips at once come into contact, and the bell is set ringing. The contact pieces can be set easily at any time by unscrewing the cap of the pillar and adjusting the rod, and this can be set to almost any degree of stiffness by more or less pressure from the screwed cap on the ball of the piston. These little instruments are sold by Messrs. T. Gent and Co., Faraday Works, Braunstone Gate, Liecester, at 10s. 6d. each. They are said to be most invaluable as detectors of garden thieves, as the strings leading from them can be readily laid among grass and foliage, and so escape observation.

Floor or Door-Mat Contact.—At Fig. 63 is shown the usual form of floor or door-mat contact. The brass barrel of this appliance is furnished with an extra stout spiral spring surrounding the stem of the flat top plunger shown in the sketch. This keeps the plunger in the position shown until pressed down with the foot, when the bottom of the stem comes into contact with an insulated stud fixed in an ebonite disc screwed into the bottom of the barrel. To fix this appliance, a hole to fit the barrel must be drilled with a brace bit in the floor, under the mat; the top part of this is countersunk to receive the lower part of the cap, and then the flanges of the cap let in flush with the surface of the floor. The wires are laid along beneath the floor, and brought up through the hole cut to receive the contact barrel; the ends are connected to the screws shown in the sketch. When placed under a mat in the doorway this appliance serves to announce the arrival of a visitor, and it is also used under the carpet of a dining-room table to enable the host or hostess to summon a servant by pressing the contact with the foot.

The Amateur Floor Contact Alarm.—At Figs. 64, 65, 66, and 67, I give detailed illustrations showing how an amateur may construct for himself an effective floor contact alarm. To do this he must rip up one or two or more floor boards under the doorway, or at any other part of the floor where the alarm is to be fixed. One floor board will be enough, but the area of contact will be enlarged if two or more boards are formed into a kind of trap-door, and then laid down again, for in this case it will be almost impossible for any one to miss treading on the trap. I take, however, one board as being sufficient to work upon for the purpose of elucidating the construction of this alarm. Having taken up the board, mark off an oblong piece on it, just between two joists, at a spot where a person is likely to tread when entering the open door. Cut this piece out of the board, as shown at Fig 66, and thus form a little trap-door with bevelled edges. To the undersides of the remaining pieces of floor board, fasten, by means of short screws, four pieces of thin spring steel or spring brass in the position shown at Fig. 64. When the contact arrangement beneath the floor has been completed, these pieces of board will be nailed down in their places and the springs will support the trap-door as shown in sketch.

Two contact springs will be required for the underside of the trap. The form of these is shown at Fig. 65. Their proportionate dimensions are shown in plan at Fig. 64, and in section at Fig. 66. I purposely omit sizes because these must be obtained by actual measurement on the spot. The springs themselves should be made out of stout spring brass at least $\frac{1}{2}$ in. in width, and the curved ends should have a bit of platinum foil soldered to them where they are likely to come into contact with the contact block beneath the floor. The base plate to which they are riveted must be long enough to span the space between the steel springs supporting the trap, and the springs long enough to reach the contact block as shown in Fig. 66. The contact block is to be made out of a piece of boxwood or of ebonite to the shape shown at Fig. 67, and should measure when finished: height 2 in., width $1\frac{1}{2}$ in., thickness 1 in. The lower part of the block, beneath the tapering part, must be coated with thin sheet brass, with a bit of platinum foil soldered just where the tips of the springs are likely to come into contact with the brass when the trap is pressed down. This block must be fastened to a strip of $\frac{1}{2}$ in. deal secured to the joists and supported as shown at Fig. 66. The floor boards may now be nailed down, and the wires from the alarum system connected to the steel springs as shown at Fig. 64. When the trap is put in its place it should be kept by the tips of these springs at least $\frac{1}{4}$ in. above the level of the floor if intended to be under a mat or carpet. The tips of the contact springs should also be resting on the taper wood part of the contact block. If all has been made aright, the trap will sink when trod upon and the current from the battery will pass by way of the steel springs to the brass springs and the circuit be completed through the metal coat of the contact block.

This form of floor contact possesses the advantage of being easy to construct and keep in order. All the contact points are what are known as "rubbing contacts," and therefore not likely to get rusty or coated with dust. Should any of the parts require attention, the trap can be easily removed and the parts repaired.

The Closed Circuit Alarm System.—To more effectually foil the nefarious schemes of the electrically educated thief, a system of electric alarums has been invented, which depends upon the action of an electro-magnetic relay always connected with a constant battery. This relay keeps the local circuits of the alarum bells open whilst its own circuit remains closed, but should the crafty thief discover the wires and cut them, the circuit of the relay is at once broken, and it then throws into action the local battery connected with the alarum bell. The battery used in this system is a form of the Daniell known as the sulphate gravity battery. In this form, a lead cylinder perforated with small holes at the bottom, and filled with sulphate of copper crystals, forms the negative element in a glass or porcelain cell. In the same cell, suspended near the top from a wooden cover, a massive ring of zinc forms the positive element. The cell is first charged with dilute sulphuric acid, then a saturated solution of copper sulphate is carefully poured into the lead cylinder so as to float the dilute sulphuric acid on its surface. The superior specific gravity of the copper sulphate solution keeps it at the bottom of the cell below the dilute sulphuric acid, unless the cell is shaken or the solutions agitated. This battery keeps in good working order whilst constantly in action, hence its use for this purpose.

If this system is adopted throughout a house all the contacts must have a reversed action; that is to say, they must be made to keep the circuit closed whilst all the doors and windows are closed, but to break the circuit when any of these are opened. No attempt should be made to conceal the

wires and connections as it will be an advantage should they be discovered and cut.

Alarums for Empty Houses.—When well-to-do householders flit to the seaside or to the moor for their summer holidays they cannot always leave their houses in the care of servants or care-takers. They therefore lock up the premises and depart in some fear and trepidation lest the house should be broken into during their absence. Messrs. T. Gent & Co. have made arrangements for supplying a specially constructed loud-toned gong to be fixed on the outside of a house and connected with the alarum system inside. Notice should be given to the police that a house is thus protected whilst its owners are away, when they will hold themselves ready to pounce on the thief as soon as the bell gives notice to them of his intrusion. Of course it will be understood that the bell is not placed in a prominent position to be easily seen by the intending burglar, but it will be best heard if placed high up on the house.

In this series of papers I have not pretended to give an account of all the little contrivances made and sold as burglar alarm contacts. Either of the firms mentioned by me will have much pleasure in supplying any special forms to meet special circumstances, and to advise on the fixing of the same. I will also endeavour to do what I can through the medium of "Shop" to assist with my advice any reader who may wish to make or repair his burglar alarums. The subject of fire alarms and other automatic alarm systems will be dealt with in future papers.

OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

101.—MOORE'S PATENT FOLDING CHAIRS.

A REALLY easy chair is a piece of furniture much to be desired in every house, especially a chair that is made in such a manner that the inclination of the back to the seat may be varied at pleasure from an almost erect position to one that is very nearly parallel to the floor without difficulty or much exertion on the part of the operator, and which, when the relative positions of back and seat have been thus altered, is so constructed as to retain the form which is desired and required without shifting either when touched or sat upon, as is the case with not a few folding chairs that are said to be secure and stable. The best chairs of this kind—best because they satisfy all the conditions that one naturally looks for in an easy chair whose back may be raised or lowered at pleasure, namely, stability, ease, and comfort—are, as far as my experience goes, to be found in the Patent Folding Chairs manufactured by Mr. J. T. Moore, of Macclesfield, and sold by any upholsterer in the United Kingdom, or, if not in stock, can be procured from the manufacturer for any customer at short notice. The principle on which these chairs are made varies in some cases, but that which governs the construction of most of them will be understood from an inspection of Fig. 1, from which it will be seen that the front legs or supports of the chair and the sides of the framing of the back are combined in two large strips of wood that run in one and the same length from the top of the back to the floor, and that the hinder supports are attached to these by bright brass grips, whose hold on the long bars can be released or tightened at pleasure, and which move up and down the back, and thus raise or lower the seat to any inclination desired.

These Patent Folding Chairs are distinguished by different names according to size, form, or fittings. Thus in Fig. 1 an illustration is given

Fig. 1.—The "Waverley" Patent Folding Chair.

of the "Waverley," a luxurious and comfortable hammock chair or lounge chair, nicely upholstered with a strip of carpeting that forms both seat and back, and yields to every movement of the body, to which it affords a strong but most comfortable support. The ends of the framing are firmly planted on the ground, and contain within the straight lines drawn, or that may be drawn, from one to the other, a sufficient area to impart perfect stability to the seat. This chair is said to be one of the best chairs made for use on a lawn or ship's deck, and it can be used when opened out only eighteen inches from front to back, thus rendering it of great utility in cases where room is a consideration. The "Trafalgar" is like the "Waverley" in form and construction, but the frame is more strongly made, and thus perhaps it is more suitable for gentlemen's use as a lounge, hammock, or deck

Fig. 2.—The "Hygienic" Patent Folding Chair.

chair, while the "Waverley" meets the less exacting requirements of the ladies in every particular. The "Pliant," another chair of this class, is placed on rockers, and so are the "Gem" and "Little Gem," most useful chairs, very portable, and suitable in every respect for drawing-rooms, sitting-rooms, and bedrooms, as well as for outdoor purposes. The last-named chairs differ from the "Waverley," "Trafalgar," and "Pliant" in having the inclination of the back regulated by means of a rack on the underside of the seat bars, in connection with the spindle on which the seat bars rest. The "Hygienic," illustrated in Fig. 2, is like the "Pliant," but has a rack at the seat bars and a regulator fastened to the back instead of the grips. When made with arms it is a good nursery chair, and a child may be put to sleep in it. It is specially recommended for invalids, because the peculiar wave-like motion induced by it when in use relieves constipation. "Its action," says the inventor, "is perfect massage without the toilsome labour, and, as prevention is better than cure, the daily use of its gentle, undulatory motion will greatly assist the liver and bowels in securing that vigorous health which is of so much value to every one. A great advantage of this chair is that it combines a perfect rocking chair with a perfect lounge, the restfulness being such that it has many times been used as a bed. THE EDITOR.

MASONRY CLASSES AT SOUTH KENSINGTON.

THE Editor of WORK has much pleasure in saying that he has received the following letter from the Secretary and Members of the Committee for the formation of these classes, dated 17, Shepherd's Place, Upper Kennington Lane, S.E.:—

"DEAR SIR,

"We earnestly request your favourable consideration of the enclosed syllabus of masonry class to be held at South Kensington under the direction of Lawrence Harvey, Esq., F.R.I.B.A., etc., and should you believe the lessons therein are calculated to give a sound knowledge of masonry and construction, and prove a scientific basis of training for masons desirous of rising to the positions of foremen or clerks of works, we respectfully solicit your help to bring these lessons within their reach.

"The Council of the City and Guilds of London Institute either cannot or will not reduce the high fee demanded of 2½ guineas, therefore we the undersigned have formed ourselves into a Committee to receive subscriptions from friends who consider our cause a good one, and tending to raise the general tone and character of a large body of workmen.

"We propose reducing the fee to 25s. each for all bonâ-fide masons, and even this amount, with the addition of railway fare and other expenses, forms a large sum for masons to pay, and it is to their credit that many are now anxiously awaiting the result of this our effort in their behalf."

In giving publicity to it, the Editor has only to add that a letter to the Secretary at the address given above will at once procure for the applicant a syllabus of the classes and a prospectus of the "College of Masons."

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

PRIZE COMPETITION DESIGNS.

IN reply to correspondents who have written pointing out that engravings of these designs did not appear in No. 30 of WORK as announced, the Editor takes the opportunity of explaining that it was considered to be more useful to readers to give working drawings of them instead of small sketches, as was originally contemplated, and that they will shortly appear in turn with descriptive matter explaining mode of construction, etc. etc.

I.—LETTERS FROM CORRESPONDENTS.

"Muntin," and Suggestions to our Writers.—W. B. (*Liverpool*) writes:—"I observe some correspondence in 'Shop,' No. 27 (see page 428) regarding the derivation of the word 'muntin.' I find it given in Ogilvie's Imperial Dictionary as follows:—'Munt (Scotch), to mount. Muntin, or munting, the central vertical piece that divides the panels of a door.' It is evidently a corruption of the word 'mounting.' May I offer a suggestion as to articles in WORK? There is a tendency in some writers to shorten their descriptions, and to offer supplementary instructions through 'Shop,' if required. The effect is to leave the instructions a little vague, and so much is taken for granted that it is sometimes difficult for an unskilled hand to follow them. That is not satisfactory, and though the deficiencies may be made up in 'Shop,' it is only when some one asks for the details. Besides,

you will no doubt have correspondents all over the world, to whom the columns of 'Shop' cannot be of much service in that way. The delays are too great. I regard WORK as so valuable that I should be sorry to see its usefulness impaired for want of a little extra trouble on the part of the authors. Many of your readers are no doubt, like myself, very amateurish, and require full and complete details of construction from beginning to end, but observe it has only to be done once. Having given such instructions for, say, a bookcase, camera, etc., in all future designs of similar character, readers could be referred to those instructions for details. Do not think I complain of WORK—it is the best value for its price that I have seen for a long time. I do not like to mention names, but Mr. Adamson's instructions about the bureau are the kind that I and many others require. I cannot follow the articles on the camera, kaleidoscope, sideboard, etc., so easily."

Tin Ovals, etc.—A. N. (*Airdrie, N.B.*) writes:—"Being a reader of your paper, WORK, I may say I am well pleased with it, also the remarks in 'Shop,' which is a first-class feature in it, and which I find very interesting. I may say I am in the metal stamping line, and am pleased with B. M. Ramsden's paper. I also noticed the fanners in 'Shop,' of which I have made a few before seeing same. The only difference in mine is I have spindle running on centres as underneath, which causes less friction, and can be altered in case of blades rubbing on side, having gam nut on the screws. I may say I have made a fern case and aquarium combined, and seeing inquiries for same, I hope to see papers on it. But, Mr. Editor, would you be as kind as to ask some reader for a description of machine or oval rollers for making oval tin bodies with locked seam, such as mustard and tobacco tins, or makers of same, or put me in correspondence with one who knows? I may say I would give something to have a fast method for forming oval bodies. I hope you will be as kind as to put this inquiry before your readers."

Machines for Current of Air.—FITTER (*Walsall*) writes:—"I have noticed a sketch or two of machines for producing a constant current of air, and I should be glad of the dimensions for making same."

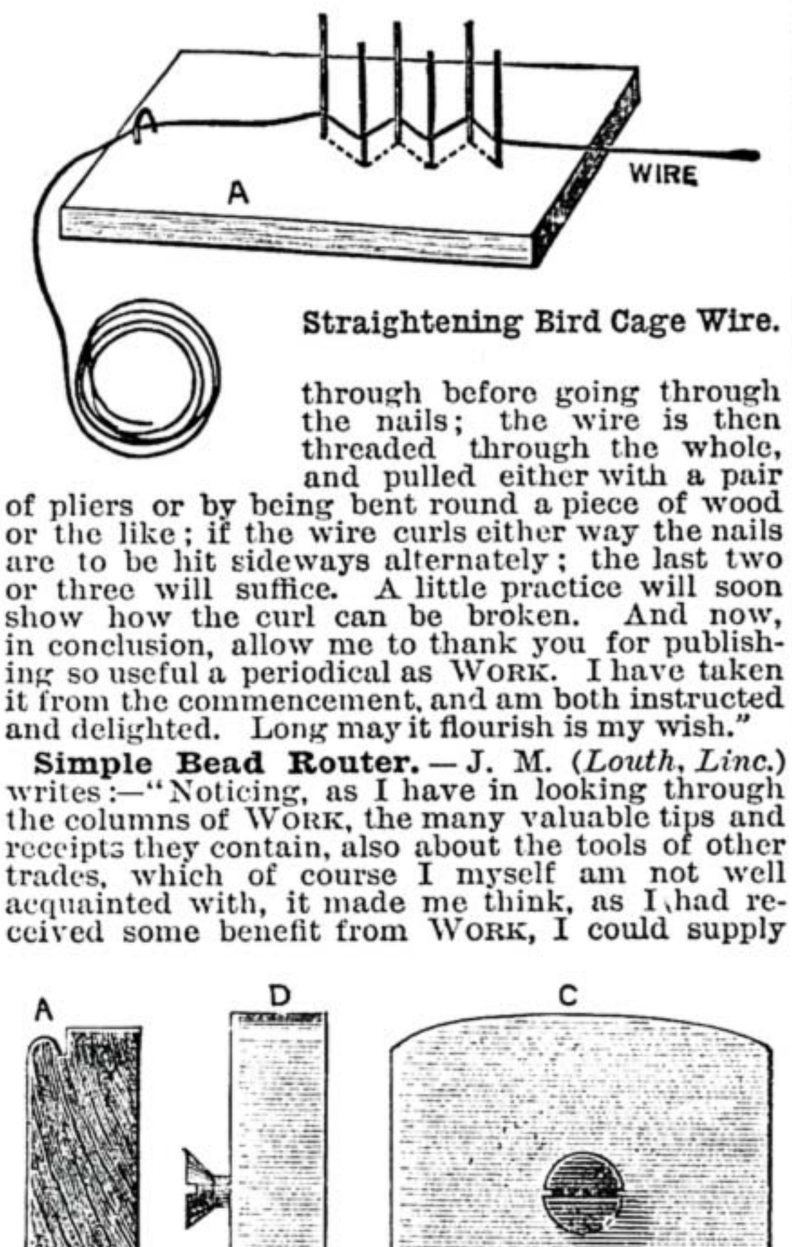
Chamfer Plane.—APPRENTICE LAD (*Leicester*) writes:—"In No. 20, on page 316, J. W. (*Burton-on-Trent*) writes that he has made a chamfer plane from working drawings published in the *Carpenter and Builder*. I should be very much obliged to him if he would kindly give me the drawing in 'Shop,' so as to make one myself. I think others would like to make such a useful tool too. I am very pleased with WORK."

Blacking Gladstone Bags.—R. A. P. (*South Kensington*) writes:—"Seeing in your issue of 24th August (page 365), a paragraph entitled 'Gladstone Bags,' recommending Berlin Black for renovating same, I endeavoured to get some, but found that it is seldom kept in stock by shopkeepers, though it could be got to order, but not less than a gallon. I therefore got some of Harris' Black Leather Varnish, sold by Harris & Son, 33, Beech Street, Barbican, E.C., and found it answer admirably, drying quickly, and it is quite elastic and pliable. Twopennyworth is sufficient for a large bag."

A Hint to Fretsawyers.—C. E. (*Streatham Hill*) writes:—"It may be worth knowing that half a dozen or more exact copies with once tracing can be taken of a design without spoiling the original by placing underneath sufficient sheets of Japanese paper and carbonic paper, and tracing with the end of a needle stuck into a wooden holder. For instance, if six copies should be required, six sheets of the Japanese and three sheets of the carbonic paper would be required, as the latter is prepared on both sides. The paper, being so extremely thin, can easily be removed from the cut work with a damp sponge, provided it has been stuck on with thin paste. Being also transparent, the reverse of a design can be got by simply turning it over. I may mention that Messrs. Isaac Pitman & Sons, of shorthand fame, Amen Corner, supplied me with small quantities of the above."

Wheels, etc., for Mail Cart.—W. P. writes:—"Readers of WORK who reside in the North of England and are desirous of building a mail cart can buy their wheels and other requirements of James Henry, 95, Port Street, Piccadilly, Manchester, who supplies wood wheels at 4s. per pair, rubber wheels at 5s. per pair, and other things equally cheap; Alfred Parker, 60 and 62, Great Ancoats Street, Manchester, who supplies rubber tire wheels with axle at 5s. 6d. per pair; and Owen's Toy Bazaar, 84, Ancoats Street, Manchester, where rubber tire wheels may be bought at 5s. 6d. per pair, and spider wheels (without rubber tires), springs, and axle at 7s. the lot. Readers residing at a distance, and unable to get these things in their own locality, should write before making a remittance, giving the height of wheels required and inquiring price."

Straightening Bird Cage Wire.—A. E. D. (*Birmingham*) writes:—"In No. 27 of WORK (see page 429) are a few remarks *re* straightening wire, but all have not the use of a set of tinman's rolls, so I take the liberty of sending sketch of a simple method which will straighten any kind of wire, either hard or soft, which I hope will be useful to readers of WORK. In the illustration A is a strong piece of wood into which strong nails or pieces of thick wire are driven, not straight but zigzag as shown. A staple is also driven for wire to pass



Straightening Bird Cage Wire.

through before going through the nails; the wire is then threaded through the whole, and pulled either with a pair of pliers or by being bent round a piece of wood or the like; if the wire curls either way the nails are to be hit sideways alternately; the last two or three will suffice. A little practice will soon show how the curl can be broken. And now, in conclusion, allow me to thank you for publishing so useful a periodical as WORK. I have taken it from the commencement, and am both instructed and delighted. Long may it flourish is my wish."

Simple Bead Router.—J. M. (*Louth, Linc.*) writes:—"Noticing, as I have in looking through the columns of WORK, the many valuable tips and receipts they contain, also about the tools of other trades, which of course I myself am not well acquainted with, it made me think, as I had received some benefit from WORK, I could supply

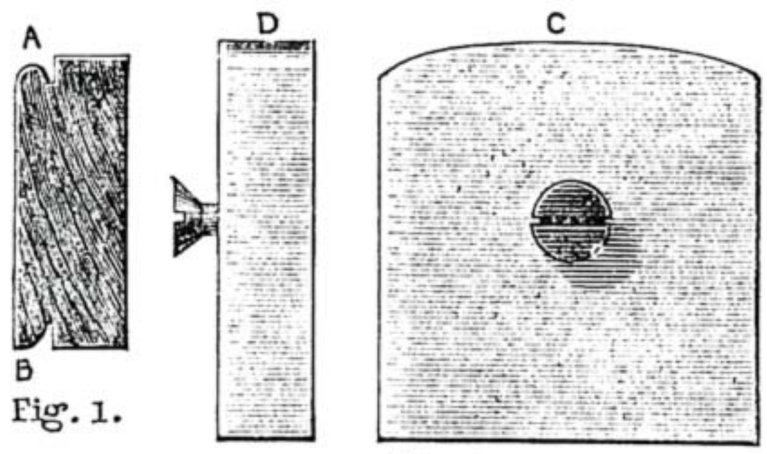
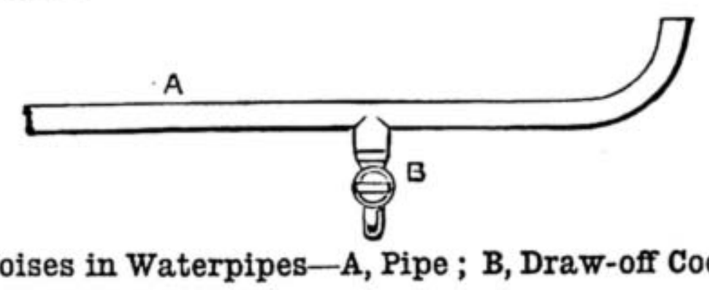


Fig. 1. Fig. 2.

Fig. 1.—Examples of Beading. Fig. 2.—Bead Router in Plan (C) and End View (D).

some of our amateur friends, as well as practical friends, with a design for a very simple and yet very useful and cheap tool, which they all could make themselves. It is a tool (of course I call it a tool, though, perhaps, some would not call it so) for making beads on the edge of doors, or any other article that requires a bead on an edge. I enclose sample of beading, also the tool itself. You will notice one bead is finished with just the edge taken off with a smoothing plane (as at A in Fig. 1), and the other at B, just cut with the screw head, and not finished with smoothing plane. The tool itself is shown in plan (C) and section (D) in Fig. 2."

Noises in Waterpipes.—E. G. B. (*Rochester*) asks:—"Can you tell me the cause of waterpipes humming, and a loud lapping noise occurring when water is drawn? How can I remedy the above defect?"—To this query I may reply:—The noise referred to by E. G. B. is caused by turning the draw-off cock suddenly when there is a high pressure of water. The simplest remedy is to have a screw down cock, or have the pipe lengthened thus:—



Noises in Waterpipes—A, Pipe; B, Draw-off Cock.

Microscope Making, Etc.—G. E. G. (*Bradford*) writes:—"The instructions given by O. B. in No. 22 of WORK describe the brasswork part most minutely, but nothing much is said about the most important thing (viz., the optical part), excepting a little about the eye piece, which was of great interest to me. He says there is nothing that an ingenious worker cannot do except the few castings in brass. How would the instructions read if applied to the metal work of a clock, and nothing said about the number of teeth, or the diameter of wheels and their mode of action? I consider it just as vague. The metal work to me now is child's play, but the optical part I don't know much about. I should esteem it a great favour if as good a description of the lenses could be given. I don't mean the making of them, but as to their focal positions, diameters, etc. I, when a boy of fifteen, read an article in *Design and Work* respecting the making of a microscope; the instructions given were mostly about the diameters, positions, and focus of the lenses. I procured the proper lenses mentioned from London, and made the thing according to instructions, but was disheartened on the completion, as the definition of the objects was very bad. I then had the opportunity of examining a professionally made one, and found my lenses to be absurd in diameter and as regard to their positions. Now I wish to point out that such descriptions get young lads and amateurs to spend their time and money, until they come to such a disappointment as I did in my first attempt, when the whole thing is given up in disgust. Perhaps I am too rash in not waiting to see if the subject is to be continued or not. However, here are two or three more things that would put the damper on a boy who commenced to make (1) machine for current of air, No. 19, p. 302. It certainly has a slight look of a fan—perhaps a little resemblance to a Capell Mine fan—but driven in the wrong direction the vanes curved the wrong way, and no inlet for the air shown. (2) An easily-made fret machine, No. 21, p. 332. The most vital part not shown, how is the motion given to the saw frame by a cam—eccentric or what; and how on earth would the connecting rod pass the axle, fixed in the way it is shown? (3) Soldering in repairs of sheet metal utensils, No. 23, p. 354. Now everybody would not know, in attempting such soldering, that the least particle of zinc left on his iron or solder would give no end of trouble in attempting to mend a kettle or especially a soft metal teapot; a good solder for Britannia metal or pewter contains bismuth to make it more easily fused, so as not to endanger the article. This trouble I had to find out at the expense of spoiling a good teapot. I now keep a piece of solder to itself that I use for zinc only, as good solder gets contaminated when soldering galvanised metal. I am also very careful to file off all the old facing from the iron after using it for zinc. (4) Lock repairing and key fitting, No. 21, first page. Our friend says the chisels for chipping out the keys cost about 6d. Most amateurs in attempting chipping metal with such small chisels would soon send their sixpences flying. I had to find out that using a chipping chisel requires a good deal of skill. A boy reading that subject, and seeing how simple it appears to be to cut keys, would speculate a shilling or two on the tools, and in the end be disgusted at his chisels breaking. I admire such a remark as regards buying a cheap vice, as I once bought one; the thread stripped in a very short time. I trust you will see what I am aiming at, not exactly being sarcastic, but simply pointing out that a little more detail and caution might be put in the subjects to make them more easily understood by the younger folk, as really my (1) and (2) would make a practical man study before he could understand what the drawings were meant to illustrate. I think if such drawings were submitted to more practical men before being cut less time and money would be wasted. I am not reflecting discredit on the whole of the subjects, as I consider most of them splendidly described. I am now nearly thirty, and have always taken a paper of this sort since being thirteen years old—*Design and Work*, or *English Mechanic*, and now WORK, which I consider by far the best for amateurs. I am speaking for beginners, as you will see what difficulties I have met by attempting these things which appear easy to make or do. In my opinion every lad should have a hobby and be encouraged, as a very little thing makes him give it up if everything does not go right, and then he will perhaps turn for the worse. My father encouraged me by buying a small cheap lathe for a Christmas-box when very young, and used to help me out of many a difficulty. I now possess a facsimile screw-cutting amateur lathe that took the only medal for lathes at an exhibition held in my town. My hobby now is a good help on my weekly salary."—[Your letter contains just the kind of criticism that is desired and courted, and the recommendations given will no doubt be accepted, remembered, and acted upon by those to whom they refer. You must remember, however, that many a skilled hand, writing on a subject with which he is perfectly familiar, will omit reference to some necessary point, because it happens to be so well known to himself that he imagines it is equally well known to all for whom he is writing. I endeavour, however, to impress on every writer the desirability and necessity for being minute in detail, so that those who are ignorant of processes, etc., under description or discussion may be helped to as perfect a comprehension of them as possible. Whenever a volunteer writer describes and illustrates in "Shop" anything that is not actually feasible, it is desired that either queries should be put to elicit better information on any points which may not be intelligible, or a description supplied which clears up anything that may not be perfectly plain.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Papers on House Painting, etc.—J. H. Y. (*Sunderland*).—Articles on house painting and decorating were commenced in Nos. 27 and 29 of WORK, and these are furnished by one who is both a skilled hand at the work and a competent writer. Receipts for making varnishes, greases, cements, patent driers, etc., will appear in "Means, Modes, and Methods" when sent in by correspondents who have tried and tested them; but I regret to say that up to this time I have had but very few contributions to this portion of the Magazine. I cannot comply with your request to facilitate an interchange of receipts between readers of WORK. Send me any that you may have by you, and they shall

appear in due course; and, if you set the ball rolling, without doubt others will follow your good example.

Shells.—VULCAN (*Greenwich*).—The firm can claim the application of the punches and dies to the purpose without limiting themselves as to size. If you use similar punches and dies for the same purpose, you infringe the patent, and an injunction to restrain you from so doing can be obtained, even although your punches and dies are of different sizes from those used by the patentees.—F. C.

Revolving Stereoscope, etc.—T. G. (*Hattonle-Hole*).—I daresay some correspondent who understands the construction of this instrument will send a paper on it, in which case it shall appear for your benefit. With reference to house painting, see above reply to J. H. Y. (*Sunderland*). A folding bench for amateur woodworkers will appear very shortly, and will be followed by another on the mode of making a good stout and serviceable work bench with convenient fittings.

Book on Sign Writing.—W. F. M. (*Commercial Road, E.*).—The book on "Sign Writing" referred to has been out of print for years.—H. L. B.

Printer's Roller.—J. P. S. A. (*Penryn*).—Without knowing the size of the roller, or the materials of which it is made, it is impossible to give directions how to renew it. Printer's rollers are generally composed of glue and treacle, one pound of the former to a gallon of the latter. About one-third of the old material could be mixed with the new. The casting is accomplished by pouring the composition into a mould, the wooden or metal stock occupying the centre. As, however, the casting of a roller is a difficult task to any one who has not done it before, we would recommend your having it renewed by a practical maker.—J. F. W.

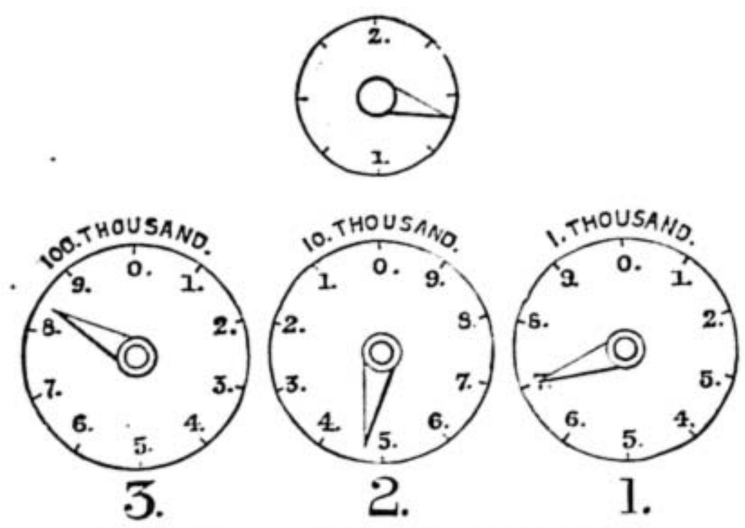
Accumulators.—JAMES (*Peterboro'*).—(1) Start charging the cells with current of a low E.M.F., and raise its tension as the cells get charged. Continue the charging current for thirty hours, or ten hours a day for three days. When, at the end of this time, gas is seen to come off in bubbles from the plates and the liquid appears milky, the charge is complete, and each cell should then have an E.M.F. of from 2·2 to 2·5 volts. Always discharge the cells through a high resistance, and let this be greatest at first if you wish the plates to work well. Always fully charge the cells before commencing a discharge, and do not continue the discharge when the E.M.F. falls below 2 volts. (2) Brown plates are positive plates, and grey plates are negatives. You must have both. (3) Unpasted plates require occasional reversing charges, but this is a delicate task, and should be conducted with great care. The reversing current must be very small at the start, and be gradually increased until the cells are fully charged. A rapid charge or discharge is always liable to scale the plates. See Sir David Solomon's book on the "Management of Accumulators."—G. E. B.

Medical Coil.—H. D. (*Heaton Norris*).—The necessary description and illustrations for a medical coil would take up too much space in "Shop." I may tell you, however, that the primary wire must be wound on by itself, and the secondary wire wound over the primary wire in the same direction. The two should not be connected together. In constructing one with different powers, each power has its own secondary wire. An article or two on coils will be given when space can be spared for them.—G. E. B.

Carriage Varnish.—J. R. (*Glasgow*).—I do not think any one ever makes his own varnish nowadays. For many reasons it would be a very risky experiment, and amateur's varnish would be almost certain to spoil a carriage, etc. As I do not know your requirements I can only advise you to obtain the best carriage varnish from any good oilman at about 16s. per gallon. If, however, I were compelled to make it myself, I should try the following recipe, as the source from which I take it—Spon's Recipes—is most reliable:—"Best pale carriage varnish: 8 lbs. of 2nd African copal; 2½ gallons of clarified oil: boil till very stringy; ¼ lb. of dried copperas; ¼ lb. of litharge; 5½ gallons of turpentine, strained; 8 lbs. of 2nd sorted gum anime; 2½ gallons of clarified oil; ¼ lb. dried sugar of lead; ¼ lb. litharge; 5½ gallons of turpentine; mix with the first while hot." This is, of course, for a large quantity, but the various ingredients might be reduced proportionately for small quantities.—OPIFEX.

Solution for Developing Negatives.—AMATEUR (*Oldham*).—To make a concentrated developer dissolve:—No. 1. 4 oz. sulphite of soda; 30 grains of citric acid; 9 oz. hot water; when cold add 1 oz. pyrogallic acid. Call this solution No. 1. No. 2. 2 oz. carbonate of soda pure; 10 oz. water. Call this No. 2. For use take 30 drops of No. 1, add 2 oz. of water, and just before development add 1 oz. of No. 2. This makes a capital developer for most makes of plates. Ordinary clean washing soda will answer in case of difficulty in getting the pure article. You had better try Ilford ordinary plates, and be very careful to use no more light than absolutely necessary for development, especially at the beginning of the process. Both solutions will keep indefinitely before mixing together.—E. D.

How to read the Index of a Gas Meter.—H. N. (*Chelsea*).—The four circles represent the indices of an ordinary dry gas meter. The indicator, or hand of circle marked 1, has to travel once right round to register 1,000 feet, once right round circle 2 to register 10,000, and once right round circle 3 to register 100,000 feet. That is to say, that the hand of circle 1 must have travelled once right round before that of circle 2 is on the 1, which will show that 1,000 feet have been used; and the hand of circle 2 must have travelled right round once, and that of circle 1 ten times, before the hand of circle 3 is on the 1, which will show that 10,000 feet have been used, and so on. Now to take the state



Indices of Ordinary Dry Gas Meter.

of meter, commence at circle 1, and whichever number the hand is on or nearest to, that will indicate hundreds. You will notice I have put it at 7 or 700. (Bear in mind that it would have to go right round to be 1,090.) In circle 2 you will notice that the hand is between the 4 and 5, but, although it is nearest to the 5, you call it 4, which makes it 4,700. The reason you call it 4, and not 5, is because the hand has not reached 5, but has passed the 4 and about three-quarters, or 700, over. In circle 3, the hand is between the 8 and 9, very nearly half-way, which makes the reading 84,700. The small circle above merely indicates units, and need not be taken any notice of. As the indices of both wet and dry meters sometimes vary with different makers, I will soon put you right if your index does not correspond with the diagram above on receipt of particulars.—E. D.

Plating.—C. E. (*Plainville, Hartford Co. Conn.*).—You are perfectly correct regarding platina plating. It simply means platinum plating. There are no solutions I am sorry to say at present in the market (at least that I could recommend) to plate and oxidise at the same time. You could, however, add a little platinum bichloride to your bath, but it is, as a rule, a little troublesome to work. A good method and solution for oxidising silver is the following:—Take 1 lb. of sulphur and dissolve it in 1 quart of boiling potash solution, prepared by dissolving ½ lb. of caustic potash in 1 quart of water (cold). When the reaction following this has stopped and the vessel is cold, pour in sulphur and boil, stirring the solution well, then cool and filter. This gives a fine oxidising solution. If work is too light add little more sulphur and boil, but if too dark dilute with water (with little caustic potash dissolved in it). To use this, well clean the article to be oxidised, then immerse for a minute in this; then dry on a piece of warm iron, and polish with rouge. I do not quite understand what you term the *dull* finish of goods, but if you work with excess of cyanide and small anode the work will darken slightly. The quicksilver method is worked by means of amalgams; either gold or silver is made into an amalgam with mercury, and the work to be plated is covered with this amalgam. The mercury is then volatised off by the aid of heat, which leaves the metal on the article, which then, generally speaking, will bear burnishing. I do not know of the so-called black nickel solution; send me details of its preparation and I will advise. Any further information you or any brother platers may require I shall be very pleased to give. I will also see about another article for the profession.—F. W. M.

Etching Materials.—CUPID (*Castlejohn*).—I have never heard of such a compound as an etching mordaunt. Hydrochloric acid and nitrous acid are the two generally used for etching on copper and steel.—F. M.

Spence's Metal.—J. S. B. (*London, E.*).—Try Billington & Newton, Longport, Staffordshire.—J.

Telescope Tubes.—H. N. B. (*Middleton*).—Let me tell Mr. B firstly that, from actual experience, I can't help him. Though I have dealt with many a "brass telescope tube," I have never needed to blacken the interior of one, for the reason that the blackening is a luxury rather than a necessity. The dull, dead, coppery colour of the drawn brass, in its first unpolished state, I have always found sufficiently unreflective. This for the astronomical telescope; the stops commonly inserted in a terrestrial telescope should render any special darkening of the tubes still less necessary. However, I will give what help my knowledge can. The fumes of burning straw will darken a brass surface, and this is the only homely process that I know. Of satisfactory chemical methods which do not necessitate elaborate manipulation the simplest is this: Dissolve soft copper in nitric acid (scraps of wire covered with the raw acid until they are taken up), and dilute the resultant solution with water. Heat the brass slightly, and apply the solution freely with a soft brush. Then raise the heat of the metal until a sufficiently intense colour is obtained, and finish off with an oiled rag. A considerable degree of heat is necessary to obtain a good finish. Mr. B. may not be aware that a stop that will shut out extraneous light can generally be applied to a telescope without injuring the value of the instrument.—E. A. F.

Size and Glues.—GARRETT (*Dewsbury*).—I am not aware of any work treating specially on the manufacture of these articles, and since I have made special and particular inquiry with those who ought to know, I do not think anything of the kind has been published. Although glue is an article of somewhat ancient usage, size, as now prepared for distemper, painting, etc., is comparatively but a recent development. The gilder prepares the size he uses in "water-gilding" from parchment cuttings, which are put into an iron vessel, covered with water, and then simmered for many hours until all the "virtue" is extracted. The size thus obtained is called "clear size," and is the purest and clearest of any used. The commercial "double" and "extra double," as the ordinary qualities are called, are doubtless prepared from similar gelatinous sources, viz., from the hoofs of different animals, cuttings of hides, and all such refuse of the slaughter-house. In the North of England, I believe, a good clear size is made from tripe-dresser's refuse, trotters, and so on. Although used almost exclusively by painters, in preference to dissolving the glue one's self, the old style in London and other large centres, there must be a good demand to pay for its manufacture on a large scale, since in hot weather size easily putrefies. Young's Patent Size is a much stronger and more transparent make than the two kinds of glue-size before mentioned, and commands a big sale in the metropolis. Various forms also of powdered glue, termed "concentrated size," "size powder," etc., find a ready sale in the trade. A useful account of the method of making glue is, I believe, contained in Spon's "Workshop Recipes," price 5s., published at Charing Cross. The following is a brief description of the process. The hide clippings, hoofs, and such like refuse of the tan-yards are first treated with lime, then dried by exposure to the air, and afterwards simmered in boiling water for a considerable time. The liquid thus obtained is concentrated by evaporation, and when cold and "set" forms a jelly which is cut into blocks. The blocks are then dried by two processes—first by exposure to air in suitable chambers, and afterwards in heated chambers. The process of drying by exposure requires every attention, for change in the weather may spoil the whole batch. The spring and autumn, when the atmosphere is least variable, are the best periods for this drying. Glue in a liquid form is prepared by dissolving the substance in water, and adding alcohol. If GARRETT had given definite particulars I might have assisted him more practically. My advice to him is, get permission to go through a glue factory. If this is not within his reach I may further assist him through our Editor.—F. P.

Tram Car Starter.—AD VALOREM (*Hull*).—Your sketch does not clearly show the action of the foot-brake in regulating the accumulation and distribution of energy, but there is another point which seems fatal to the successful action of your apparatus. Suppose you are running in the direction shown by the arrows in your sketch, and having the friction wheel on the axle in gear with the upper friction wheel of the energy storing arrangement when making a stop, then to make a fresh start in the same direction, the lower friction wheel of the storage gear must be brought into gear with the friction wheel on the axle; unless there is some pawl or detent which is not shown in your sketch, your spring would go down with a rush while you are lifting your friction wheels; in fact, directly the top one leaves the axle wheel. In the arrangement described in the slip you enclose there is evidently a lock of some sort which is released by the pull upon the traces. Your idea of accumulating energy in running down hill and giving it off again is ingenious, but the details do not show how you do it. I should imagine though you would require a long and very heavy spring to make much of this.—F. C.

Exposure Tables.—J. B. R. (*Liverpool*).—There are no tables compiled specially for instantaneous work. Burton's exposure tables are as good as any, but the use of tables of any kind is confined to time exposure.—E. D.

Harmonium.—AMATEUR (*Peckham*).—Papers and plans on this subject will appear as soon as the season for winter work sets in.—ED.

Cricket-bat Handles.—AMATEUR (*Sheffield*).—We are unable to name any shop where cane or whalebone handles are on sale, as they are probably made for "the trade" only; it is likely that they could be procured through any dealer in cricket appliances. But why should not AMATEUR make them for himself? The best cane for the purpose is said to be the male (solid) jungle-cane. This is cheap: in large quantities it may, perhaps, range from £2 to £4 per ton. Whalebone is a more costly thing, and may cost as much as 14s. per pound. The material is merely cut into strips, 3, 4, or 5, as may be desired, and glued together.—A. Y.

Lathe Band.—W. E. H. (*Bognor*).—You ask how to secure the hook and eye of the "gut" band so that it will not come off. The first thing is to get the hook and eye the right size for the gut; have them of such a size that you can screw the gut in when only very slightly pointed with a penknife or chisel; you should not have to reduce the gut except at the very point. Screw the gut in a

vice, slightly grease the end, grasp the hook in a hand-vice, and screw it on without stopping till it comes through; it must screw on rather hard; if you stop it may be difficult to start again; if it won't go on far enough, you can't unscrew it; the only thing is to cut off the end, and bore the bit out of the hook, then slightly reduce the end of the gut, and try again. When you have got the hook on tight, cut away with a penknife whatever bit of gut comes through into the hook; then heat a skewer red-hot, and pass it momentarily through the hook to sear the end; it must be only a quick touch. Now put on the eye the same way. I never have trouble with mine. It is possible you may have bad hooks and eyes with a bad thread; mine come from J. Buck, 56, Holborn Viaduct, as also the gut. You probably know you can tighten your band by twisting it up a turn before hooking it, and it can be loosened a little by untwisting in the same way, thus you can adjust it to a nicety, according to the weather. The Editor will appreciate your good wishes, and you will soon overcome this slight difficulty.—F. A. M.

Cheval Screen.—W. A. Jr. (*Portglenone*).—Your idea of a cheval screen whereon to display your flower pictures is undoubtedly a happy one. Have you thought of utilising a once popular variety, that is a little difficult to explain without diagram, but is practically the shape of Fig. 2 (page 196), with two panels that draw out, one on either side? Yet I do not know that this is any real gain; it would add to your labour, and need a harder grain than pitch pine possesses, to make the framework strong, and yet slender enough to work in a satisfactory way. I should suggest (as perhaps you intend) ebonising the pine, or enamelling it with white. Either white or black produces a good frame, but the colour of pine, especially in conjunction with gilt moulding, is rarely a success. As a practical hint, I would advise you to use the stout cheap German millboards for mounts, and be quite sure to paste the pictures (or backing paper) on both sides while the paste is wet. If you allow one side to warp in drying, as it most assuredly will on any pasteboard, it is almost impossible to get it to keep quite flat again. So be quite ready to cover each side of the panel, and, as soon as possible, lay the whole under a smooth board, with a few bricks or other heavy weights, to keep it taut in drying. If you could work a moulding of the same wood, and apply it in place of gold (which has always, in these sort of things, a cheap and shoddy effect), I think you would find it in much better taste, or you might rabbet the mount, or tack on a simple beading.—J. G.-W.

Sword Smith.—H. B. (*London, E.*).—You seem to know so well what you want, that it is only the matter of finding a good sword smith (not a mere sword manufacturer). Mr. H. Mole, sword maker, of Birmingham, might give you reliable information; or by a visit to that town, or Sheffield, amongst the sword cutlers, you might try testing blades, and form an opinion of the merit of the tempering. The shape you should supply by a wooden pattern, which prevents any mistake being made by the smith in his work. A single sword of a different pattern would cost more than an ordinary blade. When done you should be sure to try it before the hilt is fixed. The scabbard is unimportant, except for actual service, or to test the best form of suspension to the rider if it be for a horseman. The maker named is sure to use the best steel, as would any sensible sword smith, as it would not cost a shilling more than common steel. £50 is not an out-of-the-way price for a presentation sword, which means forty odd pounds are paid for hilt, scabbard, and fancifying the blade. We are pleased you approve of the way our writers tell readers the how and why of work, and further help learners by telling the how and why of failures. An illustration of logic in work, as well as in words, was given by a sword-smith to a manufacturer. A sword smith, who now is in the United States, was contending with his employer for his claim for better pay. "It is not logical," said his employer, "for you to expect more than any other smith." The smith took up a sword blade made and tempered ready for grinding—*i.e.*, making worse—and fixed it in a vice, and with a sword he had tempered, with one blow cut the other blade in two, with but slight harm to the better blade. "That is my logic," said the workman, scornfully, as he turned away from one whose ignorance was made manifest by his bad sword blade making.—J. C. K.

IV.—Questions Answered by Correspondents.

Tools.—H. C. (*Clapton Park*) writes in reply to G. P. (*Edgeley*) (see page 366):—"The tools he should have to commence with as actual necessities are—a jack plane, a smooth plane, hand saw, 24 in., tenon saw, 8 in.; hammer, turnscrew, oil stove, oil can, three chisels—say, ¼ in., ½ in., ¾ in.; rule, 2 ft.; square, 4½ in.; two bradawls, two gimlets. Your correspondent would find it pay the best to have good tools, and not the cheap ones, and I think he cannot do better than go to Messrs. Syer & Co., of 45, Wilson Street, Finsbury Square, London, who have a good assortment, and where he could also get information practically demonstrated in the use of the tools, if he desires same. I found the firm very obliging in showing the uses of the various tools I have had from them. Of course there are other makers, but I, myself, do not know of one who has a carpenter's shop wherein to try and see the uses of the tools one is buying."

Finishing Brass.—R. L. (*Raheny, near Dublin*) writes in reply to S. H. D. (*Newtown*) (see page 366):—"Gold lacquer, or brass finishers' lacquer, can be got in three shades of colour at most oil shops. To use it on small articles to prevent tarnishing after thoroughly cleaning the brass, warm the metal in a Bunsen burner or spirit lamp, till the back of the hand will just bear it when placed against it; then apply the lacquer quickly and evenly with a soft brush. Do not go over any part twice, or a stain will result. When done pass the article quickly through the flame a few times, and leave to harden. Should the brass be too hot the lacquer will dry or burn at once, and leave marks on the metal, and if too cold the brass will have a foggy or dull appearance."

Removing Ink Stains.—R. L. (*Raheny, near Dublin*) writes in reply to LITTLETON (*Worcester*) (see page 366):—"To remove ink or iron mould stains from linen, moisten the linen by holding it in the steam from boiling water, then apply weak hydrochloric acid on a piece of stick. When the stain is dissolved out wash the article well to get rid of any acid."

Insurance of Workman's Tools.—DONOVAN (*Thrapston*) writes in reply to J. K. (*Oxford*) (see page 366):—"You would, I think, do well to join the Hearts of Oak Benefit Society, for by so doing you would (among other things) insure your tools for £15. An application to the Secretary, Hearts of Oak Benefit Society, 17, Charlotte Street, Fitzroy Square, London, W., will procure the necessary forms and information."

Removing Ink Stains.—L. M. (*Putney*) writes in reply to LITTLETON (see page 366):—"You can easily remove ink stains by moistening them with a weak solution of oxalic acid."

Flour Paste Souring.—A. J. C. (*Finsbury Park*) writes in reply to J. R. (*Skerries*) (see page 238):—"To every half-pint of flour paste (without alum) add 15 grains of powdered corrosive sublimate, and mix well; this, though not attacked by insects, is extremely poisonous.—N. B.—Keep in a covered pot."

Drilling Square Holes.—B. A. B. (*Hampstead*) writes in answer to A READER (see page 270):—"There is a plan described in one of R. S. Burns' books, which consists of a square steel tube the required size, ground and sharpened inside to a chisel edge. This square tube surrounds an auger, or Jennings' twist bit, which fits the tube as nearly as a round tool can. The bit has an adjustable shoulder, brought into contact with blunt end of tube, so that the bit bores a hole, which the square tube, which is thereby forced into contact with the wood, immediately cuts into a square mortise. A READER will see that care must be taken to begin the square hole correctly, and that there is a portion of hole left circular."

Regilding Looking-Glass.—F. P. writes in reply to B. N. (*West Ham*) (see page 333):—"As it may probably save disappointment to the worker, allow me to supplement G. R.'s answer to the above by a few lines. Take your frame and clean off dirt, and with it the old clear size; this is a right commencement; but, in nine cases out of ten, a frame requires something else before it can be gold-sized and properly gilded. Nearly all new frames are gilded by water-gilding process (I make no allusion to German lacquered stuff), and, therefore, beneath the exquisitely thin layer of gold we have an absorbent surface. A frame is seldom regilded until some of the gold is worn and rubbed off; and, therefore, to put 'japanners' gold size' upon it without any other preparation, means that the latter will invariably be absorbed into the 'size and whiting' surface underneath, and, consequently, the gold cannot stick. We can touch it up afterwards, of course, but workmanlike methods and amateur makeshifts are two vastly different matters. In any case of regilding, it is always advisable, if not necessary, to give the article, after cleaning, a coat of either French polish or thin 'patent knotting,' applied evenly and expeditiously; or, what is the better job, a thin, bare coat of white paint, made with lead, turps, and a little 'japanners' gold size' in it to dry and harden it. 'Japanners' gold size,' as a medium for gilding upon, is only an 'amateur's touch,' and such as no good job of gilding is done with. Get a little of gilders' oil gold size, spread very barely with a soft hog-hair fitch (working on white paint one can see where one is going), stand it aside, out of dust, until the next day, and then lay on the gold leaf. Wipe off very gently as G. R. directs, and finish with clear size, a bare, even coat, or a weak solution of isinglass, which is more readily dissolved; a pennyworth will do a score of frames."

V.—Correspondence Briefly Acknowledged.

A READER.—Much obliged to you for your advice, which shall be acted on if found expedient or practicable to do so. J. R. (*Skerries*).—The articles on plans, etc., for building cannot be commenced in the present volume as there are already so many subjects in hand. W. R. (*Old Street*).—I acknowledge the receipt of your letter, which is all that is really necessary for me to do. What you do not care for, others take pleasure in, and *vice versâ*. G. S.—Electric lighting will be treated in WORK. DESIRE (*Peckham*).—Plumbing will be treated in WORK in due season.

Trade Notes and Memoranda.

RECENTLY, at Messrs. Beardmore & Company's Parkhead Forge, Glasgow, the casting took place of an unusually large shaft for a dynamo machine. Over seventy tons of metal were run into the mould, which was sunk more than twenty feet into the ground. The casting was of Siemens steel, and will be hollowed to a diameter of twelve inches. When finished the shaft will weigh about thirty-two tons. The dynamo for which the shaft is intended is being constructed to the order of the London Electrical Supply Corporation, and will be the largest in the world. The casting was in every way successful, and would take fully a week for the metal to cool.

A NEW YORK correspondent says that besides the clippings resulting from the manufacture of various articles, an immense amount of tinplate scrap is wasted every year in the form of empty tins and other similar objects. Many processes have been devised for utilising the scrap by separating the tin from the sheet iron, but they all failed more or less, either from a technical or a commercial point of view. An American inventor has hit upon the idea of converting the tinplate scrap into nails, and although considerable difficulties had to be overcome at the outset, it is stated that the machinery has now been so greatly improved that it enables a boy to produce nearly 1 cwt. of nails in a day, the cost of the scrap in America being at present about 9d. per cwt.

A ROMAN correspondent says that the well-known firm of Ansaldo-Bombini in Sampierdarena have recently completed the colossal engine and boilers intended for the Italian ironclad *Sicilia*. The engine is constructed to work up to 19,500 horse power, and it is the most powerful hitherto constructed in Italy. It is constructed on the compound principle, with eight cylinders and four surface condensers. It drives two four-armed screws, which have a diameter of six metres. The weight of the boilers is 500 tons, and the total weight of the engine and boilers is 1,740 tons.

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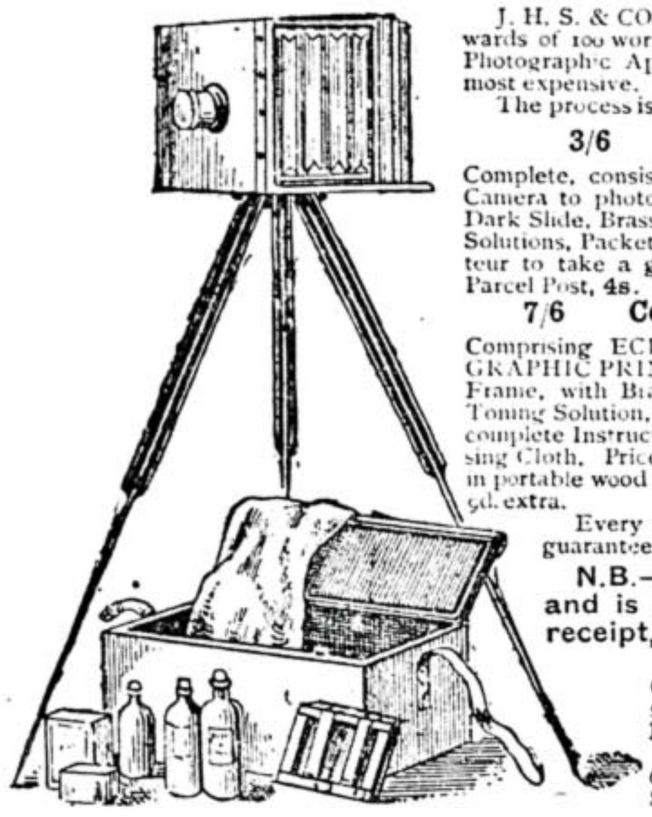

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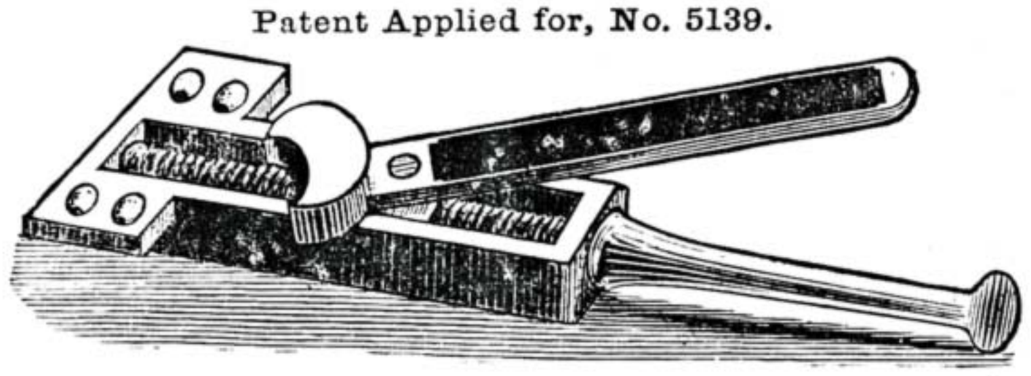

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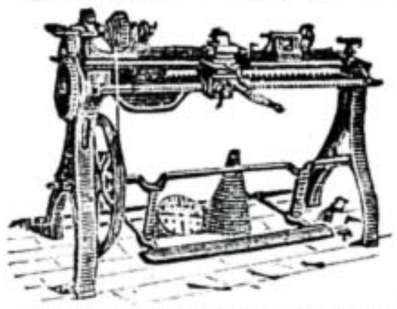

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